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THE CONDOR

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JOURNAL OF THE COOPER ORNITHOLOGICAL CLUB

THE CONDOR

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MEXICAN CACIQUE
CASSICULUS MELANICTERUS
One-half natural size
Painting by Andrew Jackson Grayson

THE CONDOR

VOLUME 52 MAY-JUNE, 1950 NUMBER 3

DISTRIBUTION OF ALBATROSSES IN THE NORTH PACIFIC AND ADJACENT WATERS

By KARL W. KENYON

Because of the pelagic wanderings of albatrosses, ornithologists find relatively few opportunities to observe them. The difficulties involved in collecting these birds in the open sea from ocean-going vessels often compels us to accept sight records of their occurrence. Thus our knowledge of the geographical and seasonal ranges of albatrosses is largely fragmentary when we compare it to our knowledge of other species. The general range of the Black-footed Albatross (*Diomedea nigripes*) in the North Pacific and southern Bering Sea has long been known (Bent, 1922:5). Its seasonal occurrence in these areas is still not fully established. The observations of Starrett and Dixon (1946) and others indicate that observations from many areas at different seasons should be assembled before we are more fully able to understand the seasonal wanderings of this species. The previously recorded range of the Laysan Albatross (*Diomedea immutabilis*) does not indicate that it occurred formerly as far north as observers and collectors in recent years have found it.

The opportunity to gather the following observations on albatrosses was afforded during several cruises aboard the Fish and Wildlife Service vessels "Black Douglas" and "Penguin" in 1947, 1948, and 1949. These cruises took us as far into the Bering Sea as the Pribilof Islands, along the Aleutian Chain to Attu, across the Gulf of Alaska and across the North Pacific Ocean from Unalaska to San Francisco, California, and through the waters off California, Oregon, and Washington (see chart, fig. 21). Dr. Victor B. Scheffer and I spent many hours in the wheelhouse on all these cruises and kept notes on the albatrosses observed. In addition, information was gathered by several other observers and kindly put at our disposal.

BLACK-FOOTED ALBATROSS

Gulf of Alaska.—On cruises in May, June, and July, usually 3 or 4, but as many as 10 or 12, remained about the ship all day. They joined us about 10 miles from shore and generally left at about the same distance as we approached land. As late as October 13 and 14 they were with us constantly between Kodiak and Sitka. However, in November we found that their occurrence in the Gulf was unpredictable. On November 25 and 26, 1947, while crossing the northeastern side of the Gulf, several remained about the ship during all daylight hours. On the 26th one of these remained with us after we had passed Cape Spencer and continued circling the ship until we were four miles within Cross Strait, an unusual proximity to land. Between November 12 and 16, 1948, we passed through the same area without seeing one albatross.

North Pacific Ocean.—On November 26, 1948, we left Unalaska and headed directly for San Francisco where we arrived on December 6. For the first three days out we saw no albatrosses. At sundown on November 30, over 900 miles from Unalaska, the first Black-footed Albatross joined us. From this point on, from 1 to 10 were with us during all daylight hours until we reached the Farallon Islands just off the Golden Gate.

Between December 8 and 18 we cruised between San Pedro, California, and Cape Flattery, Washington. After leaving the Channel Islands we ranged from 30 to 175 miles off shore. From 5 to 15 albatrosses were with us every day.

Bering Sea and Aleutian Chain.—Although the Black-footed Albatross may be depended upon to follow a ship across the Gulf of Alaska during the spring and sum-

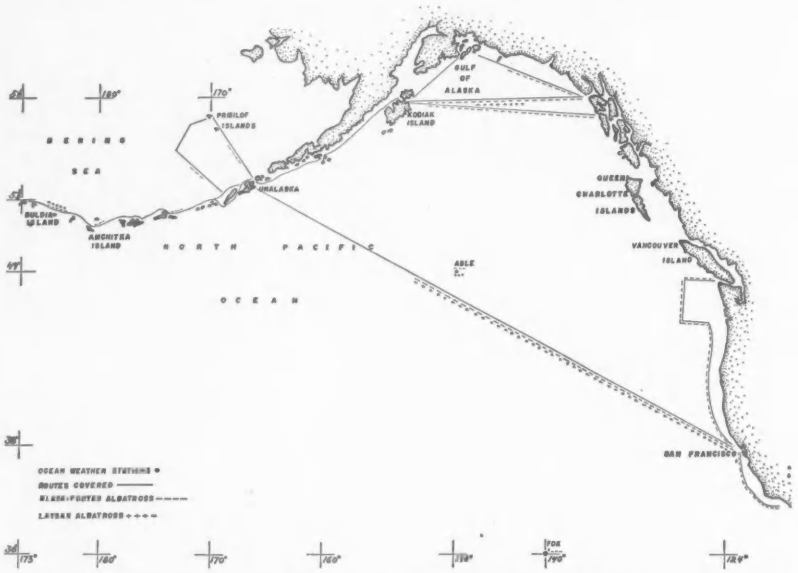

Fig. 21. Map showing areas where albatrosses were observed on cruises of 1947, 1948, and 1949.

mer, conditions are quite different in the southern part of the Bering Sea. Between Unalaska, in the Aleutians, and the Pribilof Islands, 200 miles north of there in the Bering Sea, albatrosses are quite irregular in occurrence. Along this route on October 23, 1947, November 23 and 25, 1948, and May 8 and 9, 1949, we saw no albatrosses. On July 8, 1947, several joined the ship for a few hours during rough weather about halfway between Unalaska and the Pribilofs. A few days earlier, on July 4, while the ship wallowed through heavy seas southwest of the Pribilofs, and about 100 miles northwest of Umnak in the Aleutians, four albatrosses circled the ship for an hour or more. During five days of cruising in the Bering Sea between July 3 and 9, those mentioned above were the only ones observed.

Between October 27 and November 17, 1947, we cruised along the Aleutian Chain from Unalaska to Attu and back. On October 29, about 10 miles north of Amlia Island three albatrosses joined us. On November 7, a stormy day, 5 to 10 remained with us all day while we neared the western extremity of our cruise, passing Buldir Island about noon. We returned through this same area on November 11. The day was clear and sunny with a light breeze blowing, but the albatrosses had completely vacated the area. The only other individual of this species observed later was one that followed us for a short time near Amchitka Island on November 13.

Dr. Olaus J. Murie summarized his notes on the Black-footed Albatross in the Aleutian area for the summer of 1937 in the following statement: "On May 31, while passing to the north of Seguam Island, in the Aleutians, many albatrosses were following the ship, at least 9 having been counted at one time. They were common also all the way westward to Kiska Island, where they were noted fairly near shore on June 3. They were much in evidence near Petrel Banks. Albatrosses were noted casually elsewhere among the Aleutians, usually only one or two at long intervals" (MS, 1937).

Fig. 22. Black-footed Albatross in flight over ship.

It is interesting to note that our observations of the Black-footed Albatross in the Bering Sea were always made during quite rough and windy weather, although we had many stormy days when no albatrosses appeared. The southern part of the Bering Sea is apparently a fringe area for the northern occurrence of this bird, into which it moves somewhat irregularly especially in the fall and then perhaps frequently under the stimulus of certain weather conditions.

SHORT-TAILED ALBATROSS

The best available evidence indicates that the Short-tailed Albatross (*Diomedea albatrus*) is extinct. Certainly the observations and data reported by Austin (1949) would lead us to believe that the bird no longer exists. The last recorded data relating to this bird "existing in the flesh" is from Toroshima. Yamada banded 22 there on April 9, 1932. Of these, 11 were recovered there in November, 1932, and 5 on June 30, 1933 (Austin, 1949:288). Thus, I present the following observation for what it may be worth. On November 25, 1947, while en route from Cape St. Elias to Cape Spencer, in the Gulf of Alaska, and 140 miles from Cape Spencer, a dark-bodied albatross with a distinctly white or pinkish white bill, circled about the "Black Douglas" for some minutes in company with several typical Black-footed Albatrosses. The unusual bird came quite close to the ship, within about 100 feet, leaving no doubt that its bill was white. Although the white bill and dark body are characteristics of the immature Short-tailed Albatross, it is also possible, in view of the overwhelming evidence for this bird's extermination by Japanese fishermen and feather hunters, that the individual observed was an abnormally pigmented Black-footed Albatross. The plumage was a uniform

sooty with none of the usual white markings characteristic of the Black-footed Albatross. Although several Black-footed Albatrosses remained with us all day, the white-billed bird left us after circling with the others for 10 to 15 minutes. During approximately six months at sea in Alaska waters at various times in the past two and a half years this is the only bird we have seen which remotely resembled the Short-tailed Albatross.

LAYSAN ALBATROSS

Gulf of Alaska.—At noon on October 13, 1948, about 230 miles due east of Kodiak, a Laysan Albatross joined the Black-footed Albatrosses that followed the "Penguin" and remained intermittently in the vicinity of the ship until dark. As Captain Carlson and I watched the bird he told me that during his five round trips to the Pribilofs each year, he quite often sees "one or two of the white albatrosses with the black wings and back at about this same place while crossing the Gulf between Kodiak and Cape Spencer but not in the Bering Sea."

North Pacific Ocean.—On our cruise from Dutch Harbor to San Francisco a Laysan Albatross first appeared near the "Black Douglas" at noon on November 30, six hours ahead of the first Black-footed Albatross. It passed quickly as did another about mid-afternoon. Two to four were visible about the ship during all the ensuing six days until we reached a point about 30 miles northwest of the Farallon Islands. On December 6 the rough weather of the past few days had moderated and shortly before the last bird was seen I was able to collect a male at 124° West Longitude, 38° 15′ North Latitude, or about 40 nautical miles due west of Bodega Head and 75 miles northwest of San Francisco. The bird is now in the United States National Museum Collection (FWS), number 397551. The bird disgorged an entire squid about eight inches long just before it was retrieved. The stomach contained the beaks of 7 squid, 6 small roundworms, and 4 small pieces of pumice, the largest about half an inch in diameter. These small pebbles floated in water when removed from the stomach. Thus the bird may have picked them up from the sea or perhaps from the beach of a breeding island.

During the December, 1948, cruise of the "Black Douglas" along the Pacific Coast between southern California and Cape Flattery, Washington, only one Laysan Albatross was reported to me by the men in the wheel house but I saw none myself. The bird passed the ship on December 12 at some distance and did not circle or return. We were approximately 40 miles off central California, somewhat south of San Francisco.

The Laysan Albatross which we collected on December 6, 1949, 40 miles off central California appears to be the second specimen taken in what may properly be termed California waters. The first specimen was "caught" at San Nicolas Island, April 5, 1909, and was first reported to be a Short-tailed Albatross (see Peters, 1938:90). Several observers have reported Laysan Albatrosses 500 miles or more off the California coast and one was collected about 700 miles southwest of San Francisco on November 14, 1906 (Loomis, 1919:83). Further observations may show that this bird, although frequenting waters farther from shore than the Black-footed Albatross, occurs more frequently near our coast than the dearth of records now indicates.

Commander Midtlyng, who was in command of the U.S.C.G. Cutter "Klamath" during three cruises while manning ocean weather stations, kindly volunteered to keep a record of the albatrosses he saw. Commander Midtlyng is an interested observer of sea birds and mammals. While the ship was occupying Weather Station Able, 49° North Latitude, 148° West Longitude between October 11 and 31, 1948, Laysan Albatrosses were frequently seen during the entire period. On Station Fox, 30° North Latitude, 140° West Longitude, during late January and early February of 1948, several Laysans

were seen but they were rather scarce. On the same station from December 12, 1948, to January 2, 1949, only one Laysan Albatross appeared.

Dr. Gordon D. Alcorn observed three white-bodied albatrosses which he believes were Laysans during August, 1949. He saw the first two birds on August 23 "about twenty-five miles off the Washington coast just south of a line running through Destruction Island [northern Washington]. The day was very calm and there was no sea at all. The next day, August 24, there was a slight breeze and some surf, but I was able to observe one albatross. The next day, August 25, a southeaster blew up and our observations and collections were cut to a minimum. The rain was so thick that we could see but a few yards around the boat. Curiously enough, I recorded no Black-foots during the entire five days that I was off shore" (letter, 1949). The Laysan Albatross has not previously been recorded from the waters off the Washington coast. However, its appearance farther north would lead us to expect it here.

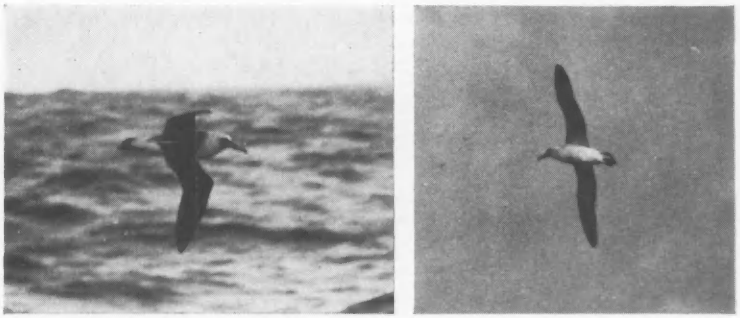

Fig. 23. Laysan Albatross. Left, photographed about 500 miles northwest of San Francisco, December 5, 1948; black back differentiates this species from the Short-tailed Albatross. Right, view of ventral surface.

Mr. Henry Hildebrand while engaged in tuna fishery research spent about 20 days at sea between August 9 and October 6, 1949. In this period operations were carried on in the off-shore waters of northern Washington, British Columbia, and southeastern Alaska between Grays Harbor and Baranoff Island. He reports that he observed two white-bodied albatrosses. In both instances the birds remained near the research vessel for an hour or more and were in company with numerous Black-footed Albatrosses. The first bird was observed between 5 and 10 miles off Tassu Sound, Moresby Island of the Queen Charlotte group. It rested on the water but remained out of range of his .410 shot gun. The second bird appeared on September 12 at 50° 58′ North Latitude, 130° 44′ West Longitude. This position is 75 miles due west of Quatsino Sound on the north end of Vancouver Island, British Columbia. He tentatively identified the birds as Short-tailed at the time, since they were within the expected range of that species. Not realizing that another white-bodied albatross might be expected in this area, he noted only that one had a black tail. Beyond this his notes are not detailed on the observations.

Bering Sea.—In the summer of 1937 while working on a biological survey of the Aleutian Chain Dr. Olaus J. Murie observed, on several occasions, albatrosses which at the time he recorded as Short-tailed but later decided were all Laysan Albatrosses: "One north of Seguam on May 13. On June 2, three or more were seen west of Atka and the following day they were even more plentiful, especially near the Petrel Banks.

Two were seen between Kiska and Chugul. We saw more in this one day than we did all last summer. On June 17 one was seen east of Semichi Island and next day another east of Buldir" (MS, 1937). On July 31 near Ulak Island, 178° West Longitude, Dr. Scheffer and Dr. Murie, who were on different parts of the ship, simultaneously shot an albatross resting on the water. It weighed 4 pounds, 6 ounces and had a wing spread of 77¾ inches. The specimen is in the United States National Museum Collection (FWS), number 366372.

Mr. Elmer C. Hanson, a civilian employee at the Army base on Amchitka, recently sent us parts salvaged from two Laysan Albatrosses which he had found dead on the beaches of Amchitka on June 5, 1949. He sent the entire head, along with the feet, of one bird and the upper mandible from the other.

Available evidence leads us to believe that the Laysan Albatross does not venture more than a few miles north of the Aleutian Chain. We have never encountered it more than ten or twelve miles north of the Chain within the Bering Sea. On November 7, 1948, one remained in the vicinity of the "Black Douglas" nearly all day as we cruised westward passing about 10 miles north of Buldir Island about noon.

Bent (1922:16) states that the Laysan Albatross ranges about as far north as 40° North Latitude. Thus this albatross has been expected by observers at sea well south of Alaska waters only. However, the Short-tailed Albatross was known to invade the Bering Sea and other Alaska waters (Bent, 1922:9). Thus the white-bodied albatross observers have expected to see in these waters was the Short-tailed. Because of the extinct or near extinct status of this bird, and in view of specimens and other observations, it seems quite probable that sight records of several Short-tailed Albatrosses, as reported by Arnold (1948:556-557) for the western Aleutians and by Gabrielson (1944: 110) for the Gulf of Alaska, include some cases of mistaken identify.

NOTES ON BEHAVIOR

Although Black-footed and Laysan albatrosses were frequently about us simultaneously, seldom did we note any friction between the two species. In one instance a Black-foot stopped to investigate what appeared to be a part of a jelly-fish floating on the sea. After raising and dropping the object with its bill several times, it lost interest and took flight. During this performance a Laysan alighted nearby and watched curiously until the Black-foot took off. Then it paddled over and attempted to swallow the object. Before it could finish, another Black-foot arrived, tormented the Laysan until it took flight, then worried it until it dropped the object. The Black-foot then alighted, satisfied its curiosity by picking at the object several times, and flew off. The Laysan then returned and when last seen was attempting to swallow the object.

A courtship performance was observed for a brief interval between two Laysan Albatrosses 40 miles off central California on December 6, 1948. The two birds paddled about on the calm sea facing each other. They exchanged several caresses, rubbing their bills together. Their attention was so fully absorbed in their actions that they allowed the ship to approach them closely and one of them was collected.

It has often been said of the Laysan Albatross that it is quite shy of ships and seldom remains near them for long. We found this to be true in part. Again, we found that certain individuals would stay with us for many hours at a time. While circling a ship it tends to fly in larger circles than the Black-foot, soaring perhaps half a mile in one direction, then crossing the ship's path to swing widely around the aerial paths of the Black-foots before veering back toward the ship.

SUMMARY

Black-footed Albatrosses occur irregularly in the Bering Sea. They are more frequently seen in the vicinity of the Aleutian Chain than farther north. Our observations of these birds within the Bering Sea were associated with rough, windy weather, perhaps suggesting that they move into this area, the fringe of their northern range, with certain weather conditions. During the summer and early fall the Black-footed Albatross is regularly seen in the Gulf of Alaska. However, in the latter half of November their appearance there is irregular. Several were observed there in November of 1947 but none in November of 1948.

A dark-bodied albatross with a white bill was observed in the northeastern portion of the Gulf of Alaska in 1947. Other observers have reported white-bodied albatrosses of whose identity they were not positive. The possibility exists that some of these birds may have been Short-tailed Albatrosses.

A specimen of the Laysan Albatross has been collected near the western end of the Aleutian Chain and parts of two others from the beaches of Amchitka Island in the Aleutians. The species was observed several times in this area, both in the summer and late fall. It has also been observed in the summer and fall in the Gulf of Alaska. The northern limit of range of the Laysan Albatross was previously believed to extend only to 40° North Latitude. The information presented extends their range to the western Aleutian area and north at least to 58° North Latitude in the Gulf of Alaska.

Two Layson Albatrosses were observed in a courtship performance on December 6, 1948, 40 miles off central California. One of these birds was collected. This is the second specimen of this species to be taken near the California coast.

Future observations may reveal that the Laysan Albatross visits the waters near our shores more frequently than past records indicate.

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THE ANNUAL STIMULUS FOR MIGRATION

By DONALD S. FARNER

Among the fascinating aspects of bird migration are its cyclic nature and its temporal precision. Twice annually, in a migratory species, there must be some type of stimulation which causes the development of the complex migratory behavior pattern. It is the purpose of this discussion to present an inventory of our knowledge concerning the nature and mechanism of this periodic stimulation. For present purposes, migration is defined as a regular, usually annual, movement of at least a portion of the population of a species from the breeding area to a non-breeding area, and a return of at least a portion of the individuals to the breeding area. It is definitely oriented and periodic but is not necessarily to be implied to "involve reproduction" as suggested by Gadow, Bullough, Rowan, and others. Care must be exercised in excluding, as non-migratory, many so-called vagrant and sporadic movements; some of these may represent initial phases in the development of more typical migratory movements or modifications of more typical migratory patterns. The traditional German designation (Weigold, 1924, and others) of "instinct" and "weather" migrants likewise should be applied with caution since the establishment of distinct differences is difficult in many instances. The latter could in some instances represent a developmental stage of the former.

With their aerial mobility, high metabolic rate, and relatively highly developed instinctive behavior, birds are perhaps the best equipped, among all groups of animals, for the development of migratory behavior. Because of these "preadaptions" for migration and further because of the peculiarly scattered distribution of migratory habits among the families and orders of birds, it appears not unlikely that migratory behavior may have evolved several or many times in the course of the evolutionary history of modern birds and that, in studying migration, we may actually be confronted with many subtle cases of convergent evolution. This in turn may mean that the selective processes, the stimulatory mechanisms, the mechanisms of navigation and orientation, and other aspects of migration could be different in different species.

With this suggestion in mind, it may be pertinent to present a few remarks concerning some of the pitfalls associated with the interpretation of experimental data and observations relating to migration in general and to the stimulation of migration in particular. (1) *The tendency to regard all migration as having a common origin, or at least, as the result of the same factors.* This assumption may be true but the available evidence, at present, generally indicates it to be improbable. There seems to be no common denominator in migration other than migration itself. (2) *The rather frequent tendency to transfer conclusions concerning one species into explanations concerning other species and to construct general theories based on evidence from one or a few species.* This is a corollary of 1. In some instances transfer may be valid; likewise in many instances it is not. (3) *Confusion of correlation with cause and effect.* This is not an uncommon difficulty in many fields of biologic investigation. Usually this has involved the assumption that in a correlation between two phenomena one must be cause and the other effect, whereas in reality both may be the effects of an undetected cause. An example in migration may well be the correlation between migration and the reproductive cycle such as in the recrudescence of the gonads. (4) *Excessive generalization.* Few experiments and observations concerning bird migration have true statistical reliability. Most data and observations in this field are, from the standpoint of the entire field, suggestive rather than definitive for purposes of generalization. Experiments which will yield significant data are difficult to plan and execute.

Two periods may be recognized in the history of our knowledge of the annual stimulation of migration.

The period of observation (1825-1925) is characterized by theories, usually unifactoral, based solely, or at least largely, on uncontrolled observations. Many of the theories bestowed on birds untenable attributes such as intelligence and ability to plan. Many confused the factors of annual stimulation and the selective factors which fix the response mechanism although it must be admitted that, in some instances, these may be closely related. The hypotheses and theories proposed during this period, in one way or another, have suggested, implied, or anticipated, most of the factors and ideas of our current concepts. As a rule, however, these theories were generalized from restricted observations, and although frequently proposed as general theories, they failed to have general application. Among the stimuli or causes suggested for migration were changes in temperature, changes in rainfall, changes in atmospheric pressure, changes in humidity, changes in food supply, urge to reproduce, urge to return to ancestral home, seeking of additional space for reproductive activities, freezing of lakes and streams, seeking of traditional nesting habitat, and "following the course of the sun." Although some important concepts were introduced, many of them passed unnoticed. The important contributions of this period are aptly summarized by Wachs (1926).

The experimental period, which is characterized by the combination of observational and experimental approaches to the problem of the annual stimulation of migration, began with the first experiments with Slate-colored Juncos (*Junco hyemalis*) in Alberta by Rowan (1925).

In these pioneer experiments (Rowan, 1925, 1926, 1929, 1931, 1946) juncos were subjected in winter to artificially increased day lengths. The testes of these birds gradually increased in size whereas in the controls the testes remained at a size normal for the season. Rowan associated the increasing size and development of the gonads of the experimental birds with the similarly increasing size and development in spring migrants. When light-treated birds were released in mid-winter, many disappeared whereas controls with undeveloped gonads remained in the vicinity. This was interpreted as an indication of migration on the part of the experimental birds.

Further experiments by Rowan (1928) on the mechanism by which increased day length caused development of the testes have led to an interesting ramification. He concluded that, in the experiments involving increased day length in juncos, a more direct cause of the increase in size and development of the testes was actually an increase in exercise. Bissonnette (1930, 1931*a*, 1931*b*, 1933) was unable to reach a similar conclusion from experiments with Starlings (*Sturnus vulgaris*). However, the extreme nervousness and restlessness of the experimental birds seems to preclude significant conclusions. Rowan (1937, 1938) contested Bissonnette's experimental results principally on the basis of observations that Starlings in London subjected to traffic disturbances but only slight increase in light showed earlier recrudescence of gonads than Starlings in the quiet suburbs. On the other hand Bullough and Carrick (1939), and Bullough (1942*a*, 1942*b*, 1945) have assembled a rather convincing body of data which indicate that Rowan was actually dealing with two physiologically distinct races.

Experiments on migration were also conducted with Crows (*Corvus brachyrhynchos*) by Rowan (1930, 1932, 1946). In winter releases of Crows, which had been subjected to artificially increased day length, some northwesterly movements were obtained; there were also southeasterly movements; also some individuals were sedentary. Castrates, similarly treated and released, with a single exception (described as a partial castrate) were sedentary or moved in a southeasterly direction. Non-castrate controls which received no light treatment were sedentary or moved in a southeasterly direction

typical of the normal migration in autumn. These results appear to indicate the necessity of the testes in the stimulation of northward migration. Schüz (1948) interprets them as indicating that both the gonads and anterior lobe of the pituitary gland are necessary. Experiments involving treatment with certain hormonal preparations were inconclusive.

Rowan (1926, 1929) first proposed that migration, spring or fall, is stimulated by hormones secreted by the testes or ovaries at a certain stage of partial development and that the regression and recrudescence of the gonads is caused by the decrease and increase in day length in spring and autumn. Later, in consideration of the results from the experiments with Crows, Rowan (1931, 1932) revised his theory to the effect that fall migration is probably not dependent on any particular stage of regression but only on regression, castration representing the maximum regression. Still later, Rowan (1946), although still placing emphasis on the role of the gonads, suggested that the pituitary gland and "the entire physiology of the animal" are involved in the stimulation of migration. Previously Cahn (1925) and Bergtold (1926) had suggested a causative relation of the vernal development of the gonads to the annual stimulation of spring migration.

Schildmacher (1933, 1934*a*, 1934*b*) has reported results from experiments on young and adult European Redstarts (*Phoenicurus phoenicurus*); these data have been interpreted (Bullough, 1945) as support for Rowan's theory of a gonadal stimulation of migration. It was reported that small injections of female sex hormone caused a cessation of migratory behavior in fall in caged birds, whereas migratory behavior persisted when larger injections were made. Schildmacher, in interpreting these results, assumed that fall migration is the result of decrease in sex hormones, whereas spring migration is stimulated by an increase in sex hormones. He then suggested that the small doses counteracted the stimulating effect of decreasing sex-hormone level whereas the large doses actually produced a simulation of springtime migratory behavior. These experiments have been criticized, with apparent justification, on several points by van Oordt (1943), Steinbacher (1933), and Desselberger and Steinbacher (1934). Stadie (1938, 1939) likewise was unable to confirm Schildmacher's results with similar experiments on the Redstart, although previously Giersberg and Stadie (1934) had reported the release of migratory behavior (*Zugunruhe*) with injections of female sex hormone in a male Whitethroat (*Sylvia communis*) and in a male Lesser Whitethroat (*Sylvia curruca*). Merkel (1938) suggests that Schildmacher's results were the consequence of increased metabolic rate.

Schildmacher (1937, 1938*b*) demonstrated, with limited numbers of European Robins (*Erithacus rubecula*) and Redstarts, premature recrudescence of gonads and migratory behavior in caged birds (*Zugunruhe*) with artificially increased day lengths. The results with Robins have been confirmed by Putzig (1937, 1938*c*). As indicated subsequently, these data need not necessarily be interpreted as indicating a cause (gonadal recrudescence) and effect (migratory behavior) relationship.

Rowan's gonadal theory of the annual stimulation of migration has been accepted in its general aspects in a recent review by Bullough (1945) as a basis of the difference of migratory status between the British and continental Starlings. Lincoln (1935) also suggested that migration was caused by physiologic stimuli associated with the reproductive period.

At this point it seems pertinent to enumerate, with brief comments, certain considerations which collectively appear to make improbable any theory of annual stimulation of migration based on the gonads as the immediate stimulators of migratory behavior.

These considerations are in addition to certain technical criticisms by Wolfson (1940, 1941).

(1) Transequatorial migration virtually precludes a simple general application of Rowan's theory of photoperiodism operating through the gonads as well as any theory based fundamentally on simple photoperiodism. Rowan (1926) recognized this difficulty and suggested that the pattern of migration may become sufficiently fixed, according to the light conditions of the northern hemisphere, so that the excursion into the reversed conditions of the southern hemisphere would have no effect on this established pattern. Moreau (1931) in a critique of Rowan's theories concludes that his suggestion of the fixation of a pattern in accordance with light patterns in the northern hemisphere is the only plausible explanation. Moreau suggested the possibility that simple response to photoperiodism represents the primitive condition in migration and that a pattern independent of photoperiodism, such as required in part by transequatorial migrants, represents a more highly evolved situation.

(2) The necessary assumption of similar (or identical) functions of the ovaries and testes, or the assumption of very similar (or identical) functions of male and female sex hormones, although not impossible, is difficult to accept.

(3) The experimental data of Rowan (1925, 1926, 1930, 1932), Schildmacher (1937, 1938*b*), and Putzig (1937, 1938*c*) show, under conditions of artificially increased day lengths, simultaneous recrudescence of the gonads and development of migratory behavior. This is also a commonly observed correlation under conditions of naturally increasing day length. These data and observations are interpreted in the gonadal hypotheses of the annual stimulation of migration as a matter of cause (gonadal recrudescence) and effect (migratory behavior). Actually, with the possible exception of the data on the light-treated castrated male Crows obtained by Rowan (1932), these data could be interpreted in terms of two effects (gonadal recrudescence and migratory behavior) resulting from a more profound cause such as possible changes in the anterior lobe of the pituitary gland in response to changing conditions of light. Cole (1933) in discussing data on the reproductive cycle of the Mourning Dove (*Zenaidura macroura*) noted that whereas it should be reasonable that there be some causal connection between annual migration and the reproductive cycle, "there has been disagreement as to which was cause and which effect."

(4) There has been a slow accumulation of records of castrated males which migrated both in spring and fall. However, only spring migration by castrated males can be construed as contrary to Rowan's (1926, 1932) theory. Such cases have been reported by Putzig (1938*c*) for five Hooded Crows (*Corvus cornix*), Hann (1939) possibly for a Red-eyed Towhee (*Pipilo erythrophthalmus*), Drost (1941) for a European Blackbird (*Turdus merula*), Emlen (Wolfson, 1942:260) for three Gambel White-crowned Sparrows (*Zonotrichia leucophrys gambeli*). This type of evidence is actually not as completely contradictory as might appear initially. Hooker and Cunningham (1938) have reported that the testes can regenerate occasionally in castrated male domestic fowl. Whether or not regeneration was actually from somatic tissue is immaterial in the evaluation of castration experiments on migration. Also it is possible that castrates without migratory urge might still accomplish migration in association with a flock of normal birds. Nevertheless, migration of castrate males does weaken the idea that the gonads are primarily involved in the annual stimulation of migration.

(5) Certain of the experimental data obtained by Wolfson (1940, 1941, 1942, 1945) are interpreted by him as contrary to the gonadal hypotheses. In experiments with Oregon Juncos (*Junco oreganus*) it was found that migration occurred in birds held in spring until gonads were at maximum size and development hence indicating, in this

species, that a certain developmental stage is not the requisite condition for migration. Injections of Antuitrin G (primarily somatotropic hormone) caused recrudescence of the gonads as well as the deposition of fat, the latter being regarded by Wolfson and others (Merkel, 1937, 1938) as a requisite condition for migration. Gonadotropic hormone preparations (pregnant mare serum and chorionic gonadotropin plus follicle stimulating hormone from the anterior lobe of the pituitary gland) caused recrudescence of the gonads but not deposition of fat. This was interpreted (Wolfson, 1945) as an indication that the sex hormones from the developing gonads cannot cause the deposition of fat which characteristically precedes migration. It is interesting to note, on the other hand, that estrogens, natural and synthetic, can cause fat deposition in both sexes (see, for example, Bird, 1946). This could not, however, account for a premigratory deposition of fat in males.

(6) As has been pointed out by Eifrig (1924), Stresemann (1934), and others, some migrants complete spring migration before there has been much, if any, development of the gonads; in such species a gonadal stimulation of migration seems improbable. Rowan and Batrawi (1939), however, have presented data on small numbers of six European migrants at the beginning of northward migration in Africa in spring; all showed the beginning of recrudescence.

(7) Sedentary species and races frequently have the same gonadal cycle as closely related migrant forms (see, for example, Wolfson, 1942, 1945, and Blanchard, 1941, on *Junco oreganus* and *Zonotrichia leucophrys*, respectively).

(8) Further it seems improbable that the profundity and temporal pattern of the physiologic changes which have been associated with migration by Groebbels (1928, 1930, 1932), Merkel (1937, 1938), and Putzig (1939) could be based primarily on the gonadal cycle.

In view of these considerations in their entirety, it does not seem justifiable to accept a general hypothesis of the stimulation of migration in which the gonads are assumed to have a generally direct, fundamentally stimulatory role. This is not meant necessarily to rule out a contributory role by the gonads under the influence of the anterior lobe of the pituitary gland, nor to disregard them as an essential part of the stimulatory mechanism in certain species, as suggested by the failure of Rowan's light-treated castrated Crows to develop reverse migration in autumn. Putzig (1938*c*) has speculated on the possible interrelationships of the anterior lobe of the pituitary, thyroid gland, and developing gonadal tissues in the stimulation of spring migration. It seems not impossible that the role of the gonads in migration may differ in different species. For the present, we must continue to note that most of the evidence does not necessarily support, and some actually denies, a simple primary stimulatory role on the part of the gonads.

At this point it appears logical and desirable to discuss briefly a phase of the investigation of the physiology of migration which has received considerable attention in Europe. This is the investigation of *Zugunruhe* which is the restlessness displayed by caged migratory birds during the migratory period. It is assumed, with apparently good evidence, that the physiology of *Zugunruhe* is a reasonable representation of the physiology of migration; consequently the investigation of *Zugunruhe* has been used as a tool in the study of the annual stimulation of migration. The phenomenon of restlessness on the part of caged birds during the normal migratory period apparently has been well known for a long time. For example von Homeyer (1881) cites Naumann's (1822) description of it in caged Nightingales (*Luscinia megarhyncha*) in February. *Zugunruhe* was also known to Palmén (1876); Wachs (1926) states that it was described in some detail by Eckström in 1828. However, the initial significant investigations were

those of Wagner (1930) who recorded the activities of Whitethroats, European Robins, Bluethroats (*Luscinia svecica cyanecula*), Song Thrushes (*Turdus philomelos*), European Blackbirds, and Redwings (*Turdus musicus*); it was noted that this restlessness in caged birds corresponded fairly closely in daily and annual patterns to natural migratory behavior, although the spring period of *Zugunruhe* extends longer than the spring migratory period.

In later papers (Wagner, 1936; Wagner and Schildmacher, 1937) data were presented on the development of *Zugunruhe* in passerine birds transported out of their normal range. Also Wagner (1937) presented data interpreted as indicating that the development of *Zugunruhe* during the migratory season is somewhat dependent, varying with the species, on the amount of food available; in Song Thrushes, low temperatures appeared to be stimulatory or augmentatory. In Robins and Whitethroats it was found that intensity of light in the experimental room at night was an important factor. Numerous investigations have been made (Ahlquist and Palmgren, 1935; Palmgren, 1937, 1938, 1943, 1944*a*; Siivonen, 1936; Siivonen and Palmgren, 1936) concerning causal and modifying factors as well as of the fundamental patterns of *Zugunruhe* in the European Robin, Garden Warbler (*Sylvia borin*), and other species. The data therefrom suggest that *Zugunruhe* is the expression of fundamental physiologic factors although environmental factors may have important stimulating, inhibiting, or modifying roles.

Investigations by Merkel (1937, 1938) on Whitethroats, European Robins, and other species have made noteworthy contributions to the physiology of *Zugunruhe*. It was concluded that *Zugunruhe* is dependent on two physiologic phases: (1) *Zugdisposition* characterized by increased food intake and changes in metabolism, such as decreased metabolic rate, resulting in an accumulation of fat and, probably more important, the ability to replenish rapidly the weight (primarily fat) lost in periods of *Zugunruhe*, or presumably in actual migration, and (2) *Zugstimmung*, the actual process of migration, expressed as *Zugunruhe* in caged birds, which the author presumed to be initiated by increased secretion of thyroid hormone which mobilizes energy-rich reserves. Temperature was found to be an important modifying factor both in the appearance of and in the intensity of *Zugunruhe*. Recorded *Zugunruhe* has been the source of the basic data in the previously cited experiments of Schildmacher (1933, 1934*a*, 1937, 1938*b*), Stadie (1938, 1939), Giersberg and Stadie (1934), and Putzig (1937, 1938*c*). The phenomenon of *Zugunruhe* has been reviewed briefly by van Oordt (1943) and more extensively in an excellent treatise by Palmgren (1944*b*). The latter suggests that the daily and annual activity patterns, of which *Zugunruhe* and, presumably, natural migratory activity are a part, are the result of a number of component activity rhythms which, from time to time, differ in the degree of synchronization.

Several investigators have considered changes in the activity of the thyroid gland as integral or fundamental in the annual stimulation of migration. Wagner (1930) in his investigations of turdid species and Whitethroats was able to produce a simulated *Zugunruhe* with injections of thyroxin. Riddle, Smith, and Benedict (1932) in comparing the physiology of metabolism of the migratory Mourning Dove (*Zenaidura macroura*) and the non-migratory common pigeon suggested that migration in the former may be explained by failure of the thyroid gland in this species to respond to colder weather by increased activity, thus necessitating a movement to a warmer area. This conforms with data presented by Riddle and Fisher (1925) and in part with that of Häcker (1926) and Watzka (1934) which are interpreted as indicating that the thyroid glands of some species of birds may become more active during colder temperatures. Kendeigh (1934) has discussed this suggestion in relation to a comparison of the mi-

gratory House Wren (*Troglodytes aëdon*) and the non-migratory English Sparrow (*Passer domesticus*).

Merkel (1937, 1938) was able to produce *Zugunruhe* in Whitethroats and European Robins in *Zugdisposition* with small injections of thyroxin or thyrotropic hormone; large doses of thyrotropic preparations interrupted *Zugunruhe*; Merkel suggested that the thyroid gland has an integral function in the annual stimulation of migration; he found his data and conclusions to be in agreement with the concepts of cyclic thyroid physiology in some species as proposed by Häcker (1926), Kückler (1935), and Elterich (1936). Merkel suggested further that the difference in thyroid activity required for migration and molting makes these two processes, in general, mutually exclusive. Putzig (1938*b*) does not share this opinion, indicating several exceptions. Merkel's hypothesis is contrary to the thinking of Groebbels (1930) who suggests that the fat accumulation characteristic of *Zugdisposition* is attained by decreased dissimilation due to reduced endocrine function of the gonads and thyroid gland.

Putzig (1938*b*), with reference to his investigations of Lapwings (*Vanellus vanellus*) and other limicoline species, reached the conclusion that the thyroid gland, because of its role in regulation of metabolism, must have a significant role in migration. His data from histologic studies of the thyroid glands of the above-mentioned limicoline species seem to indicate some correlation between migration and resorption of colloid from the follicles; however, the data are by no means conclusive.

Experiments with European Robins involving injection of thyrotropic hormone were reported to cause simulated or enhanced *Zugunruhe* in birds in *Zugdisposition*. Putzig was unable to confirm Merkel's (1937, 1938) experiments in which an excess of thyrotropic hormone was found to inhibit *Zugunruhe*. Later, in considering results of his experiments on castrate migrants, Putzig (1939*a*, 1939*b*) obviously thinks of the role of the thyroid as a part of a more intricate endocrine and metabolic pattern in the stimulation of migration.

Although the investigations on the role of the thyroid gland in the stimulation of migration are fragmentary, indecisive, and the source of contradictory hypotheses, there seems, especially in view of the known functions of the thyroid hormone and its control by the thyrotropic hormone of the anterior lobe of the pituitary gland, to be considerable probability that the thyroid gland is, in some way, an integral part of the mechanism which stimulates migration. A positive interpretation of this role of the thyroid gland should involve a repetition and extension of many of the previous investigations in light of recent investigations and interpretations of thyroid function (see, for example, de Robertis, 1949), and a consideration of the role of the thyroid gland in the more general metabolic and endocrine aspects of the problem.

A general metabolic basis for migration has been suggested or discussed by Groebbels (1928, 1930, 1932), Merkel (1937, 1938), Putzig (1938*a*, 1938*b*, 1939*b*), Kendeigh (1934), van Oordt (1943), and Wolfson (1942, 1945). Actually Rowan (1926) and Wachs (1926) have anticipated these suggestions; the latter proposes a special metabolic condition which recurs twice annually. Rowan's suggestion involves a possible interplay of several endocrine organs.

A careful consideration of the available information, experimental and observational, on the annual stimulation of migration seems to lead invariably to the conclusion that associated with the premigratory period, and apparently prerequisite to migration, are certain fundamental changes in metabolism, often reflected as fat deposition during these periods. To trace the history of the knowledge and recognition of the association of fat deposition with the beginning of migration as well as the association of fat deposition with certain fundamental changes in metabolism is difficult. According to

Wachs (1926) Naumann in 1822 associated fat deposition with the beginning of fall migration.

Zedlitz (1926) analyzed somewhat fragmentary data on monthly variations in weight for certain central European migrants, permanent residents, and winter visitants. He noted that winter visitants, such as the Brambling (*Fringilla montifringilla*), Fieldfare (*Turdus pilaris*), and Bohemian Waxwing (*Bombycilla garrulus*) arrived in fall in fat condition; considerable variation occurred through the course of the winter. The data on permanent residents such as the Magpie (*Pica pica*), the Yellow-hammer (*Emberiza citrinella*), Willow-tit (*Parus atricapillus borealis*), and the Marsh-tit (*Parus palustris palustris*), although very fragmentary, indicate a fairly constant maintenance of weight, through the course of the winter, with some fat deposition. Among migrants, Hooded Crows (*Corvus cornix cornix*) were found to be heaviest in spring; Chaffinches (*Fringilla coelebs*) arrived in good condition in spring, lost weight in summer, and almost recovered spring weight in fall; Woodcocks (*Scolopax rusticola*) likewise lost weight in summer and displayed a marked increase in fall.

Groebbels (1928), in discussing the accumulation of fat in fall in migratory species, suggested that it was the result of sort of a physiologic castration and that it might serve as an energy reserve for migration. Although the empirical observations are important, the suggestions as to the cause and functions of such depositions appear rather speculatory. Groebbels also noted the arrival in spring of birds with well developed testes and persistent depositions of fat. He (1930) later presented further data on fattening in fall, before or during migration, in a number of European migrants based to a great extent on the data of Weigold from Helgoland. Still later (1932) he presented monthly data on three male Chaffinches, one of which lived three years. Fat deposition occurred approximately during both the spring and fall migratory periods.

Linsdale and Sumner (1934*a*, 1934*b*) have published extensive data on the Golden-crowned Sparrow (*Zonotrichia coronata*) which indicate a pronounced increase in weight prior to spring migration. Wolfson (1945) has shown this increase to be the result of deposition of fat. The same phenomenon appears to be indicated by similar data (Linsdale and Sumner, 1934*b*) for the Fox Sparrow (*Passerella iliaca*) and Wolfson (1945) interpreted their data as consistent with those on the Golden-crowned Sparrow. Merkel (1937) has recorded observations on Whitethroats and other species in which marked increases in weight prior to the migratory period were noted. Baumgartner's (1938) excellent study on the Tree Sparrow indicates weight maxima prior to and during fall migration, in midwinter, and at the beginning of spring migration. Putzig (1939*b*) in reviewing the metabolic physiology of migration has regarded a premigratory increase in weight as part of the normal physiology of migration.

Blanchard (1941) has found in the migratory Puget Sound White-crowned Sparrow (*Zonotrichia leucophrys pugetensis*) that there is a marked deposition of fat before departure in spring; this deposition of fat apparently is lost by the time the birds reach the breeding area. Wolfson (1945) has added details for this subspecies by the presentation of monthly weight data. A similar weight pattern is lacking in the non-migratory Nuttall White-crowned Sparrow (Blanchard, 1941). Wolfson's (1940, 1942, 1945) observations on the migratory races of Oregon Juncos under both experimental and natural conditions in California indicate clearly an increase in weight because of fat deposition prior to migration. This does not occur in the non-migratory Point Pinos Oregon Junco (*Junco oreganus pinosus*); Wolfson feels that this is typical of sedentary forms in general. Höhn's (1947) data on sedentary Mallards (*Anas platyrhynchos*) agree with this proposition. Kirkpatrick (1944) found that female pheasants (*Phasianus colchicus*) increase in weight in spring; there was no corresponding increase in

males. These data are similar to those of the annual weight curves (Wilson, 1911) of the Red Grouse (*Lagopus scoticus*) in Britain. Conceivably this situation, which may be common among non-migratory species, could be the result of increased estrogen production by the females in spring and may represent quite a different situation than in migratory species in which weight increases occur in both sexes and therefore may not be inconsistent with Wolfson's hypothesis.

Grote (1943) has stated that Longspurs (*Calcarius lapponicus*) arrive on the tundra in spring in fat condition. Dr. Irvin O. Buss (personal communication) has informed me that Upland Plover (*Bartramia longicauda*) in Wisconsin are lean on arrival in spring and fat on departure in late summer.

Nice's (1937) very extensive data on the Song Sparrow (*Melospiza melodia*) in Ohio, however, do not conform with the general pattern for migratory species as suggested by Wolfson. Wolfson (1945) has suggested that this may be the result of the failure to separate resident and migrant individuals. Nice (1946) has consequently reanalyzed and published her data in accordance with migrant and resident status. The data on winter visitants do not indicate a correspondence with the weight cycle in the migrant races of the Oregon Junco and the White-crowned Sparrow in California. Nice (1946) has suggested that climatic differences between Ohio and California may account for the differences. It seems equally probable that fundamental physiologic differences between the species may be involved.

The extensive treatise on bird weights by Baldwin and Kendeigh (1938) like that of Nice (1937, 1946) does not support a general theory of weight increase and fat deposition prior to spring migration. Wolfson (1945) has suggested that this, in part, is because of the failure of the authors to treat the data from the standpoint of migratory status. Whereas this is partially true, a cursory examination of the data of Baldwin and Kendeigh from the aspect of migratory status, in some cases, suggests that such a premigratory increase occurs in weight in spring whereas in others it does not. In general, from this aspect, the data are inconclusive. More recently in Belgium, de Bont (1947) has demonstrated with Chaffinches, as has Wolfson for Oregon Juncos, that increasing the period of exposure to light resulted in fat deposition in migrant birds but failed to do so in non-migratory individuals. Among Wood Pigeons (*Columba palumbus*) and Stock Doves (*Columba oenas*) in spring, de Bont noted two groups, lean birds with well-developed gonads and fat birds with poorly developed gonads; he assumed these groups to be respectively, in each species, the sedentary breeding population and the migratory population which does not breed in Belgium. Wolfson (1945) has discussed, in relation to migration, other published studies of annual weight pattern. Odum (1949) has recently presented extensive data on the weight of White-throated Sparrows (*Zonotrichia albicollis*) taken in the winter range in Georgia. Two peaks, one in mid-winter and a second just prior to northward migration, are evident.

A careful consideration of the available information can only lead to the conclusion that, in some migratory forms, there is certainly a premigratory weight increase resulting from fat deposition and that in some non-migratory species or populations this pattern does not occur. Obviously there is need for extensive year-around weight studies, both of captive birds and of birds under natural conditions, such as that of Baumgartner (1938) on the Tree Sparrow. For the present it seems best to assume that the annual stimulation of migration is dependent on the development of a particular physiologic status which may result in, or be accompanied by, the deposition of fat, or which allows a rapid recovery of weight lost in migratory activity. This may be identical with, or at least contributory to, the condition designated by European investigators as *Zugdisposition*, the condition in which the migratory bird is susceptible to stimulation to

migrate (van Oordt, 1943). Vleugel (1948) has recently suggested that this condition may persist throughout the winter in certain species.

Some information is available concerning other aspects of *Zugdisposition* on the basis of suggestions by Groebbels (1928, 1930, 1932) and Merkel (1937, 1938). Among other things, these investigators have pointed out, in the passerine species studied, that in addition to the premigratory accumulation of fat, there is during the migratory period a marked ability to restore fat deposits without apparent increases in food intake. Groebbels has suggested that this ability to store fat is the result of decreased dissimilatory activity of the thyroid gland and gonads and consequent lower metabolic rate. Groebbels has reported lower body temperatures from migrating birds which have flown into the lighthouse at Helgoland. Whether this is characteristic of *Zugdisposition*, or develops after migration has begun, is not clear. The changes in the daily activity curves preceding, or at the beginning of, the migratory period, described by Palmgren for caged passerine birds may be regarded as a behavioristic expression of *Zugdisposition*. Groebbels (1928, 1930, 1932), Kendeigh (1934), Merkel (1937, 1938), and Putzig (1939) have discussed possible relations of metabolism, nutrition, reflex reaction to reduced food intake and hunger, reduced environmental temperature, and shorter days in relation to fall migration. Particular attention has been given metabolic unbalance resulting from lower food intake relative to energy demands and an automatic readjustment thereto in the form of migration. Obviously other factors would have to be involved in spring migration. Merkel (1938) has suggested that consideration be given in addition to reproductive urge (*Bruttrieb*) and homing sense (*Heimfindesinn*). In general these suggestions are highly conjectural. Much research, including investigations of the activities of the pituitary, thyroid gland, and gonads, must be accomplished before the complex metabolic changes of *Zugdisposition* are understood.

Another aspect of the metabolic basis of the stimulation of migration has received the attention of Kendeigh (1934, 1941, 1944, 1945 and 1949) and Siebert (1949). Briefly, particular attention has been given to existence energy, which includes the energy required for basal metabolism, chemical heat regulation, procurement of food and water, and the "specific dynamic action" of digestion and assimilation, and productive energy, which is the energy available above the requirements for existence at a minimum level of activity and which may be used for such activities as molt, reproduction, fat deposition, and migration. Existence energy varies inversely with environmental temperature. Food intake, the sole source of existence energy as well as productive energy, decreases directly with photoperiod. Migration, in some species, allows the avoidance of a winter photoperiod which is too short to permit a food intake adequate to supply the minimum existence energy. From the standpoint of migration, the results of these investigations are significant in at least two ways. (1) They demonstate an important basis for selection in the evolution and maintenance of migratory patterns. (2) It is possible that changes in physiologic condition associated with energy intake and the available productive energy (see also Merkel, 1938, and Putzig, 1939) in response to annual environmental cycles may initiate, in some species, the stimulus which results in migratory behavior. I believe that the philosophies of Kendeigh, Wolfson, and the European investigators such as Merkel, Putzig, and Groebbels are not as divergent as the first examination of their papers might lead one to think. In general terms, the energy relationships and utilizations demonstrated and discussed by Kendeigh may be effected by the endocrine functions emphasized in other theories.

The rhythmic reappearance of the apparently characteristic metabolic condition necessary for, and concurrent with, migration has naturally led to reflection concerning a fundamental regulatory organ with an intrinsic rhythmicity or which responds to a

rhythmic physical cycle of proper frequency. The previously discussed hypotheses involving the gonads and the thyroid gland are attempts in this direction. The inadequacies of these hypotheses has been indicated previously. Among the obvious possibilities of such a fundamental regulatory organ is the anterior lobe of the pituitary gland. This has been suggested by Bissonnette (1937), Putzig (1938*b*, 1938*c*, 1939*a*), and Wolfson (1942, 1945); only Wolfson has presented actual evidence and this is somewhat fragmentary. Rowan (1946) and Bullough (1945) deny such a role by the pituitary gland. The frequent, though not necessarily close, correlation between migration and certain phases of the reproductive cycle make probable a role of the anterior lobe of the pituitary in relation to both. If this assumption is true, it is then possible that the relatively large body of information concerning pituitary-gonad relationships may be useful in interpreting the role of the pituitary in the physiology of migration. Much of this information has been summarized by Bissonnette (1937) and Witschi (1935). Benoit (1935, 1937), Marshall (1936), and Wolfson (1941) have suggested, with some evidence, that the anterior lobe of the pituitary reacts to changes in light via the hypothalamus. Wolfson has placed emphasis on "wakefulness" in relation to the role of the hypothalamus. Consideration should be given also to the results presented by Ivanova (1935) from lighting experiments with English Sparrows from which she concluded that the pituitary gland may be stimulated simply by exposure of the general body surface to increased light. It would seem that these experiments should be repeated.

It should be pointed out here that photoperiodism, that is, periodically increasing or decreasing day lengths, has been suggested, by one mechanism or another, as basic to migratory behavior in the writings of many investigators including von Homeyer (1881), Schäfer (1907), Bretscher (1915), von Lucanus (1923), Eifrig (1924), Rowan (1925, 1926, 1931), Groebbels (1928), Wachs (1926), Wetmore (1926), Thomson (1936), Bissonnette (1937), van Oordt (1943), and Wolfson (1942, 1945). That increasing day length could serve as the basis of the physiologic condition necessary for migration has been experimentally demonstrated or strongly suggested by Rowan (1926, 1929) for Slate-colored Juncos by actual departures; by Wolfson (1942, 1945) for migratory races of Oregon Juncos by fat deposition and actual departures; by Putzig (1938*c*) for European Robins, European Redstarts, and Garden Warblers on the basis of recording of *Zugunruhe*; by Schildmacher (1937, 1938*b*) for European Redstarts and European Robins on the basis of *Zugunruhe*; by de Bont (1947) for Chaffinches on the basis of fat deposition; and by Miller (1948) for Golden-crowned Sparrows on the basis of fat deposition.

Although a hypothesis involving a cyclic function of the anterior lobe of the pituitary gland resulting from stimulation because of increased day length and decline in function because of decreased day length is attractive, there can be no general application of it in such a simple form. Few migratory cycles correspond symmetrically to the annual pattern of decreasing and increasing day lengths. Likewise such a simple hypothesis would be untenable for transequatorial migrants and for many types of migrations which occur in the tropics (Moreau, 1931). The first two objections can, in part, be circumvented by the assumption, as suggested by Bissonnette (1937), of the development of a refractory period by the anterior lobe of the pituitary gland (or another endocrine gland or glands), following a period of prolonged activity, whether it is caused by stimulation by an external agent or not. Riley (1936) has shown such a refractory period to exist in the English Sparrow in fall (September) during which time a pituitary-gonad response failed to develop with increased lighting. Wolfson (1945) demonstrated a similar period in immature resident Oregon Juncos in fall. Similarly Miller (1948) demonstrated a refractory period in Golden-crowned Sparrows in fall

during which increased light was ineffective in causing recrudescence of the gonads and deposition of fat. More recently Miller (1949) has been shown that the testes in this species during this refractory period can be stimulated to recrudesce by gonadotropic hormones. This increases the probability that the refractoriness of the pituitary-gonad mechanism lies actually in the pituitary gland.

Although there is ample evidence that some gonadal cycles, and possibly some migratory cycles, are controlled by the pituitary as influenced by photoperiodism and further that refractory periods as suggested by Bissonnette (1937) may be involved, this cannot constitute a completely general explanation for the cyclic regulation of migration. Such a mechanism would not seem feasible as the basis for tropical migratory movements which are correlated with rainy and dry seasons (Moreau, 1931). These should be examined from the standpoint of energy intake and availability and utilization of productive energy. Likewise it has been shown by Witschi (1935) that some gonadal cycles may be the reflection of an inherent internal cycle involving the pituitary gland; possibly the same could be true in some instances for the migratory cycle. Moreau (1931) suggested that there may exist all degrees of variation of migratory cycles from those which are completely dependent on photoperiodism to those with a complete dependence on internal cycles.

Moreau *et al.* (1947) have presented data on the gonadal cycles of the Black-capped Bulbul (*Pycnonothus xanthopygos micrus*), the Yellow-streaked Bulbul (*Phyllastrephus flavostriatus tenuirostris*), and a Mouse-bird (*Colius striatus mombassicus*) in Tanganyika at five degrees south latitude. Moreau is of the opinion that photoperiodism is not a factor since recrudescence occurs when day length is increasing at a rate of only 20 seconds per day. Baker *et al.* (1940) found recrudescence of the gonads of the Golden Whistler (*Pachycephala pectoralis*) in the New Hebrides to occur when day length was decreasing. Admittedly these data on gonadal cycles do not have a direct relation to migratory cycles. Nevertheless they indicate further the possibility of pituitary cycles not primarily associated with photoperiodism.

It is not within the province of this paper to cite and discuss the almost innumerable papers which are concerned with the role of meteorologic and other external environmental factors, such as decrease or change in food supply, in the initiation of migration although this aspect of the problem must enter into the construction of a general working hypothesis of the annual stimulation of migration. The possible roles of these factors, both as initiating and modifying influences, have been discussed at length by, among others, von Homeyer (1881), Cooke (1913), Wachs (1926), Groebbels (1932), Kendeigh (1934), Lincoln (1935), Nice (1937), Thomson (1942), von Haartman and Bergman (1943), and van Oordt (1943). Of particular interest are the suggestions that a bird in *Zugdisposition* is actually stimulated to migrate by an external stimulus, such as a change in temperature, which is effective in the stimulation of migration only when the bird is in *Zugdisposition*. This idea was discussed in principle by Wachs (1926) and suggested more positively by Groebbels (1932). Palmgren (1936) suggested that a drop in temperature may be the stimulus for fall migration in Goldcrests (*Regulus regulus regulus*). Putzig (1938*a*, 1939*a*) has presented evidence to support a similar contention for the European Robin. He also (1937, 1938*a*) noted increased *Zugunruhe* in spring in European Robins with increased temperatures. These observations have been confirmed by Schildmacher (1938*a*) for the same species. Merkel (1938) has suggested that Whitethroats and European Robins in *Zugdisposition* in fall may be stimulated to migrate by external factors such as a drop in temperature which he believed to be effective through increased thyroid activity. Actually, however, such observations

do not necessarily indicate whether migration would or would not have occurred in the absence of the external stimulus.

Van Oordt (1943) in reviewing the physiology of migration has suggested that migratory birds come into *Zugdisposition* as the result of internal physiologic rhythm and that during, and only during, the period of *Zugdisposition* can external factors be operative in stimulating migration. Vleugel (1948), on the basis of his observations of the winter movements of certain species of waterfowl and shorebirds in the Netherlands, has suggested that certain species, or populations thereof, may be in *Zugdisposition* throughout the winter. This would constitute a basis for winter movements in response to meteorologic changes. This suggestion, although hypothetical, is important and should be subjected to experimental investigations.

Migration is the result of the release of a complex inherited behavior pattern stereotyped in the nervous and endocrine systems. Presumably such patterns have evolved by variation and selection as in the evolution of morphologic features. Among the selecting factors may be more favorable reproductive conditions in summer in the breeding area, more favorable energy intake and energy relationships in winter (as suggested by Kendeigh), unfavorable summer temperatures in the winter area (Kendeigh, 1934), and more favorable nutritional conditions. Much more attention should be given to this aspect of migration. Complexities may conceivably exist because of temporal changes in selective factors and the retention of patterns which no longer have positive selective value but which likewise do not have significantly negative values.

Finally it should be pointed out that whatever may be the physiologic changes involved in the stimulation of migration, they must in some way affect the nervous system so that the migratory behavior pattern may be released. This problem has been recognized and discussed, among others, by Wachs (1926), Kendeigh (1934), and Palmgren (1944*b*).

A WORKING HYPOTHESIS

In devising this hypothesis I have had in mind constantly the possibility that migration may be, and most probably is, a phenomenon of multiple origin. It is consequently mandatory that a single hypothesis be constructed in only the most general terms. Further, this hypothesis is constructed with full realization of the extremely fragmentary nature of our knowledge, both from experiments and from observations under natural conditions. The ideas in this hypothesis are not original, as the materials presented previously in this paper indicate. I confess that I have no profound faith that our ultimately acceptable theories of the annual stimulation will necessarily retain any substantial part of this simple hypothesis. I do hope that this will serve as an inventory of our present knowledge and as an impetus for further thinking and planning of investigations.

It is proposed that periodically, twice annually in most species, the migratory bird comes into a distinct metabolic condition, probably as a phase of a fundamental metabolic cycle, which places the bird in a "disposition to migrate" (*Zugdisposition*). This disposition to migrate may be reflected in the deposition of fat characteristic of the beginning of migration of some species and is doubtless associated with changes in energy utilization. Other physiologic aspects of *Zugdisposition* have been mentioned previously. Data are still much too fragmentary to permit comment on possible differences in spring and fall disposition and the mechanism which fixes the direction of migration (Geyr von Schweppenburg, 1938; Merkel, 1938). The fundamental cycle which periodically places the bird in the disposition to migrate is probably the result of a cyclic function of the anterior lobe of the pituitary. This cycle could be the result of periodic change in stimulation by periodic external physical factors, changing photo-

periodism for example; or this arrangement could be modified by refractory periods following the period of stimulation; or the cycle could result from more strictly internally fixed rhythms of the pituitary alone or resulting from the interaction of the pituitary and other glands. The length of the periods of disposition to migrate must be assumed to vary considerably within and among species. Perhaps among "vagrants," "wanderers," and certain winter visitants in temperate areas (Vleugel, 1948), there may be a single period extending from the end of one breeding season until the beginning of the next. The length and actual development of the periods of disposition to migrate may also be a function of age and other factors within the species. It would be expected that the gonadal cycle, in many instances, would show certain correlations with the migratory cycle, since both are presumed to be based on the cyclic regulatory effects of the pituitary. It is not the intent of this hypothesis to exclude gonadal effects and influences from this suggested fundamental metabolic cycle. Rather it is intended to place primary emphasis on the anterior lobe of the pituitary gland in the regulation of this cycle. It is likewise considered as improbable that the gonads are a generally essential part of the immediate stimulatory mechanism.

During the period of disposition to migrate, and only during this period, external stimuli may be effective or necessary in stimulating the actual initiation of migration. For the time being it seems best to assume the greatest possible variation from total lack of necessity to complete necessity of external stimuli for the initiation of migration. It would appear in the cases of many early fall and late spring migrants that external stimuli may be unnecessary and that migration will begin in response to internal stimuli associated with the metabolism of the disposition to migrate (*Zugdisposition*). On the other hand it seems quite evident that in many cases, particularly among early spring and late fall migrants, an external stimulus during the period of migratory disposition is requisite for the initiation of migration. The failure of the occurrence of such stimuli, such as a sufficient drop in temperature, during the period of disposition to migrate, has been suggested as the explanation for the increased occurrence during recent decades of normal migrants in the breeding areas in winter in the northern United States and northern Europe, as described by Siivonen and Kalela (1937) and Lehtonen (1948) among others.

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ALTITUDINAL VARIATION IN BOLIVIAN BIRDS

By MELVIN A. TRAYLOR

It has long been recognized that there is frequently an increase in wing length in birds correlated with an increase in latitude or altitude. However, increase with altitude has not been studied quantitatively except for Rand's (Am. Mus. Nov. No. 890, 1936: 1-14) report on altitudinal variation among the birds of New Guinea. The present report embodies the results of a study of altitudinal variation among Bolivian birds, undertaken to determine if birds of the Andes show an increase in wing length to the same extent as those of New Guinea. That some increase in size takes place with altitude was noted long ago by Taczanowski (Ornith. du Perou, 1, 1884:59): "*Les formes des plaines sont plus petites que celles des montagnes. Commes ces differences ne changent pas la valeur specifique, le fait meme ne perd rien de son importance.*" But apparently no one has previously attempted to study the phenomenon quantitatively. I would like at this time to express my appreciation to Dr. A. L. Rand of the Chicago Natural History Museum for his constant help and encouragement.

The material used in the present study was a large collection of birds from the departments of Santa Cruz and Cochabamba, Bolivia, made by Francisco Steinbach during the 1930's. Tropical localities, up to 500 meters, were all within the vicinity of Buenavista, Santa Cruz. Subtropical and temperate localities, from 1600 to 3600 meters were all in the region to the north and east of the city of Cochabamba. Birds from the Puna zone come from a collection made by Steinbach in 1941 in the vicinity of Mount Sajama, Oruro, at altitudes from 3900 to 4200 meters.

The following criteria were used in selecting the species for study. A minimum of eight specimens was necessary, representing localities separated by at least 1000 meters of altitude, and of the eight specimens at least two were from each extreme of altitude. These were considered the minimum series that could be expected to indicate altitudinal variation; in most instances the series was much more extensive. Only one species, *Spinus magellanicus,* was included on the basis of a series of less than eight specimens; in this form the tropical race *santaecrucis* is characterized by smaller size, and the single available specimen amply demonstrated this difference. The wing measurements were made with the wing flattened.

Altogether, forty-two species representing sixteen families were available in sufficient series and with sufficient altitudinal range to be studied. In thirty of these the same currently recognized subspecies occupies the whole vertical range of the species; in each of the other twelve, two subspecies are included. Of the forty-two species, nineteen, or forty-five per cent, showed an increase in wing length with increase in altitude; twenty-two, or fifty-three per cent, showed no change; and one species, or two per cent, showed a slight decrease. Of most significance is the fact that out of twenty species which showed a wing variation with altitude, nineteen, or ninety-five per cent, showed an increase and only one a decrease.

ALTITUDINAL SUBSPECIES

Of the twelve species in which there are two generally recognized subspecies, ten showed a significant increase in wing length in the form of higher altitude. In some of these wing length alone is sufficient to separate the two races, but in others it is only a supplementary character. In no instance are the two subspecies merely the ends of a gradual size cline; where the change is not abrupt and clearly marked, there are color

characters which differentiate the two forms. The ten species showing an increase in wing length (with the altitudinally lower race listed first) are:

Aratinga acuticaudata acuticaudata and *neumanni* (parrot)
Pyrrhura molinae restricta and *molinae* (parrot)
Brotogeris versicolurus chiriri and *behni* (parrot)
Colaptes rupicola rupicola and *puna* (flicker)
Asthenes d'orbignyi d'orbignyi and *arequipae* (oven-bird)
Pitangus sulfuratus maximiliani and *bolivianus* (flycatcher)
Myiarchus tuberculifer tuberculifer and *atriceps* (flycatcher)
Cyclarhis gujanensis viridis and *dorsalis* (pepper shrike)
Spinus magellanicus santaecrucis and *bolivianus* (goldfinch)
Zonotrichia capensis hypoleuca and *pulacayensis* (sparrow)

The two species which failed to show altitudinal variation in size are:

Lepidocolaptes angustirostris bivittatus and *hellmayri* (woodhewer)
Compsothlypis pitiayumi pitiayumi and *melanogenys* (warbler)

An example of variation in which the smaller form inhabits the tropics and the larger the subtropics is the flycatcher *Pitangus sulfuratus*. The elevations are in meters.

	Elevation	Males	Females
bolivianus	2750	129, 130, 131, 133	125
	2500	135	.....
	1600	.....	122
maximiliani	400	115, 115, 117, 120, 122	108, 111

Similar variation is shown between temperate and Puna-zone birds, as demonstrated by the measurements of the oven-bird *Asthenes d'orbignyi*.

	Elevation	Males	Females
arequipae	4200	73, 76	69
	3900	74, 74, 76, 76, 78, 78, 79	71, 71, 72, 74
d'orbignyi	3800	63	.....
	3300	67, 67, 67, 71	66, 69
	2700	66, 67, 68, 68, 69, 70, 70	68
	2500	61, 63, 64, 64, 65, 66	62, 65, 66, 68, 68

Except for the single female of *A. d. arequipae*, there is no overlap in measurements between these samples of the races of either *Pitangus* or *Asthenes*, and they could be separated on size alone. In other species, there is some overlap in wing lengths, but color characters permit the separation of subspecies. An example of this type of variation is the parrot *Pyrrhura molinae*. No females of *restricta* were available.

	Elevation	Males
molinae	2800	143, 147
	2500	131, 138
	2000	129, 140, 140
	1500	129, 134
restricta	500	126, 137

ALTITUDINAL VARIATION WITHIN SUBSPECIES

In the thirty species studied in which only one recognized subspecies covers the entire altitudinal range of species, nine, or thirty per cent, showed an increase in wing size with altitude. Only one, or three per cent, showed a decrease.

The species showing an increase in wing length are:

Chlorostilbon a. aureoventris (hummingbird)
Phacellodomus s. striaticeps (oven-bird)
Furnarius rufus commersoni (oven-bird)
Cinclodes fuscus albiventris (oven-bird)
Suiriri suiriri (flycatcher)
Turdus amaurochalinus (thrush)
Vireo olivaceus chivi (vireo)
Thraupis sayaca obscura (tanager)
Sicalis flaveola pelzelni (ground finch)

Species showing no change in wing length with altitude are:

Leucippus chionogaster hypoleucus (hummingbird)
Xiphorhynchus brevirostris ocellatus (wood-hewer)
Upucerthia validirostris pallida (oven-bird)
Cinclodes a. atacamensis (oven-bird)
Pyriglena leuconota hellmayri (antbird)
Myrmeciza h. hemimelaena (antbird)
Pipra chloromeros (manakin)
Myiodynastes maculatus solitarius (flycatcher)
Serpophaga munda (flycatcher)
Diglossa baritula sittioides (honey-creeper)
Diglossa c. carbonaria (honey-creeper)
Molothrus b. bonariensis (cowbird)
Icterus cayanensis (oriole)
Tanagra musica aureata (tanager)
Tanagra chlorotica serrirostris (tanager)
Tangara schrankii (tanager)
Thraupis b. bonariensis (tanager)
Ramphocelus carbo atrosericeus (tanager)
Tachyphonus l. luctuosus (tanager)
Catamenia a. analis (seed-eater)

The single species which shows a decrease in size is *Habia rubica amabilis* (tanager).

The most striking example of increase is found in the flycatcher *Suiriri suiriri*:

	Elevation	Males	Females
Suiriri suiriri:	3100	.....	82
	2500	75, 77, 77, 77, 77, 81	76, 77, 80
	2150	77, 79, 79, 81, 83	74, 80, 80
	500	69, 70, 71, 74	70, 70, 72, 74, 74

Out of the seventeen birds from 2150 meters and above, only a single female overlaps the measurements of the tropical birds. However, a series of fifteen specimens from Tucuman, in northern Argentina, exhibits a range of wing measurements from 70-80, which is intermediate to the ranges shown by the two Bolivian samples. Without this intergradation it might be possible to separate a highland Bolivian race; but at present, it is evident that the two Bolivian populations are merely the ends of a U-shaped size cline. The smaller extreme of the cline is found in the Bolivian and Paraguayan chaco; it is connected by intergrading populations south through northern Argentina and then north along the edge of the Andes to the larger extreme in the highlands of eastern Bolivia.

A species which suggests a more gradual increase in wing size with increased altitude is *Vireo olivaceus chivi*:

Elevation	Males	Females
2700	70, 77	73
2500	71	.....
2000	67, 68, 73, 73	69
1600	71, 71	.....
500	67, 68	65, 65

The measurements of the single species that shows a decrease in wing size with increased altitude are given below. They are not entirely convincing, but since this is the only species that showed *any* decrease, the measurements are of interest. Only males were available.

	Elevation	Males
Habia rubica amabilis	2000	92, 93, 95, 95, 96, 96, 96
	400	93, 96, 96, 96, 98, 99, 100

Further series may well show that this decrease was merely due to sampling error. The importance of these measurements lies in the fact that they show the only decrease among the species examined, and if the difference in this case is not significant, then not one of the forty-two species examined showed a decrease in wing size with increased altitude.

DISCUSSION

It is interesting to compare Rand's (*op. cit.*) figures for the birds of New Guinea with those from Bolivia.

	Bolivia		*New Guinea*	
	Number	Per cent	Number	Per cent
Total species	42		69	
Increase	19	45	23	33
No change	22	53	45	66
Decrease	1	2	1	1
Species with representative subspecies	12		9	
Increase	10	83	8	89
No change	2	17	1	11
Species with a single subspecies	30		60	
Increase	9	30	15	25
No change	20	67	44	73
Decrease	1	3	1	2

The figures for Bolivia and New Guinea show remarkably close agreement and amply demonstrate that the same response to altitude is shown by the avifaunas of the two regions. Although one-third more of the Bolivian birds studied show an increase in wing length than the New Guinea birds, 45 per cent as against 33 per cent, it is doubtful that this difference is particularly significant, since the species studied represent only small parts of their respective faunas and they were selected solely on the basis of their abundance in collections.

Of most significance is the fact that in the two dissimilar avifaunas inhabiting the two most distinct zoogeographical regions, the Australasian and the Neotropical, between a third and a half of the species studied showed an increase in wing length with altitude and only a single species in each group showed a decrease. These similarities greatly outweigh the differences in percentages and demonstrate that this response to increased altitude is not restricted to a given region or group of birds, but is found wherever the appropriate conditions exist.

The causes of increase in wing size are not readily apparent. It is often stated that this increase is evidence for Bergmann's rule, that animals increase in size with an increase in altitude and latitude. This increase is believed to be a response to the lower temperatures at higher altitudes and latitudes, and is based on the principle that a larger body is more efficient at lower temperatures because of its proportionately smaller radiating surface. This principle, however, can not be applied directly to wing length, because that part of the wing that is measured is primarily dead, non-radiating, tissue. The increase in wing size may eventually be shown to be a reflection of a general increase in body size, but there are at present no data on the body weights of Andean birds which could be used to determine this.

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OBSERVATIONS OF SOME BIRDS OF GUADALCANAL AND TULAGI

By WALTER R. DONAGHHO

While I was in the armed forces, I spent the period from December 17, 1942, until September, 1943, on the island of Guadalcanal in the Solomons. While there, I took every opportunity to observe the island's teeming bird life. Two visits were made to the island of Tulagi, off Florida Island.

Sixty-eight species were observed and positively identified. The majority of these I was able to identify from the Ludwig Collection of birds of the Solomon Islands, which Dr. Josselyn Van Tyne of the University of Michigan Museum kindly let me examine. Others were identified with the aid of Ernst Mayr's "Birds of the Southwest Pacific" (New York, MacMillan, 1945). Nomenclature of that work is used in this paper. Dr. Mayr, Dr. Harvey Fisher, now of the University of Illinois, and Dr. G. E. Hudson and Dr. Irwin O. Buss of the State College of Washington kindly offered me advice in the preparation of this paper.

The terrain over which I worked was the western end of the northern plain of Guadalcanal, my field of operations extending east to the Berendi River. I also made trips up over Mount Austin and out toward the west end of the island, going as far as the Mamara River. Several ravines were followed up into the foothills. My campsites were as follows: two in the coconut plantations between the Lunga and Tenaru rivers, one on the top of one of the kunai grass-covered ridges running between jungle-choked ravines on the side of Mount Austin, and one in the dense jungle on the bank of the Malimbiu River, about three miles inland from Kole Point.

The west end of the plain is covered with coconut plantations, extending inland for about a mile. These begin west of the Tenaru River and extend almost to the Metanikau. There is a plantation at Kokumbona; others extend westward from the Kokumbona swamps along the coast to the end of the island. Inward from the coconut plantations on the plains are large fields of kunai grass. Dense jungle follows the streams and rivers down through these fields, thinning out a mile from the coast. The foothills to the west of the Lunga River are grass-covered, with thick jungle, known locally as "selva," choking the valleys. To the east, beyond the Berendi River, the plains are covered with jungle. Up to two miles inland, along the rivers, are groves of a woody, creeping bushy plant of the Malvaceae, and a large-leafed tree which the natives call venua. Just inland from the beach between the Ilu and Lunga rivers are open meadows with scattered venua groves, beneath which dense brush grows. The meadows between the groves are mostly covered with sensitive plants. Swamps are located at the mouths of the rivers.

In general, the birds may be divided into three groups according to their habitats. These are: the birds frequenting the dense jungle, rarely, if ever, appearing outside it; the birds frequenting the open country; and those found in all localities. In the jungle, birds such as the Golden Whistler (*Pachycephala pectoralis*), Fan-tailed Cuckoo, Ultramarine Kingfisher, Chestnut-bellied Monarch (*Monarcha castaneiventris*), Pied Monarch Flycatcher (*Monarcha barbata*), and the Broad-billed Flycatcher are lovers of shade, frequenting the lower portions of the jungle and rarely getting into the tree tops (scientific names not supplied here are given in the notes which follow). The Brown-winged Starling, Shining Cuckoo, Buff-headed Coucal, Papuan Myna, and Yellow-eyed Greybird are found higher up, amidst the canopy foliage. The Buff-headed Coucal often comes down to the ground to feed. The parrots and pigeons forage in the tree tops, while the Midget and honeyeaters are in the outer foliage. The flycatchers and whistler are

fairly uniform in their distribution, while the fruit and nectar feeders congregate where their particular foods are abundant. A banyan will be visited by most of the doves and pigeons, the parrots, Papuan Myna, Papuan Hornbill, Brown-winged Starling, the Yellow-eyed Greybird and the Cicada Bird (*Edolisoma tenuirostre*).

Fig. 24. View west from Mount Austin over the kunai grass areas and jungle-choked ravines on Guadalcanal. A patch of devastated jungle shows in lower left corner.

The Little Starling (*Aplonis cantoroides*), Willie Wagtail (*Rhipidura leucophrys*), Sunbird, White-collared Kingfisher, Rufous-brown Pheasant Dove (*Macropygia mackinlayi*), and White-bellied Greybird (*Coracina papuensis*) frequent the open country. The coconut groves are frequented by the above open-country species except the Pheasant Dove and Little Starling. Dead trees that stand in the open apart from the others attract the Whiskered Tree Swift (*Hemiprocne mystacea*). They may also afford perches for the Dollar Bird (*Eurystomus orientalis*), which sits and waits for its insect prey. This bird also frequents the jungle edge, where it can get unobstructed views of the surrounding terrain.

The Spotted Button-Quail inhabits only the kunai grass meadows and ridges. The White-rumped Swiftlet and Glossy Swiftlet (*Collocalia esculenta*) cruise back and forth over these areas and along the edges of the jungle in search of insect prey.

The Coconut and Cardinal lories, White Cockatoo (*Cacatua ducorpsi*), Midget, Yellow-bellied Sunbird (*Nectarinia jugularis*), Solomons Honeyeater, and Red-knobbed Pigeon (*Ducula rubricera*) frequent both the jungle and the coconut groves.

The destruction of the jungle by the fighting drove out the forest-loving species, and those frequenting the open country made their appearance. Table 1 shows the successional recovery of the jungle from a completely devastated condition and the successive changes in bird life. Of the various stages, only the fourth, or complete recovery

stage is uncertain. I did not see any jungle that had reached this stage, but judging from the growth of new trees in several of the shot-up areas, I assume that the jungle would make enough recovery to attract the shade tolerant species.

The bird life of the coconut groves is limited to the Coconut and Cardinal lories, the White Cockatoo, the Willie Wagtail, White-collared Kingfisher, Sunbird, Midget, Solomons Honeyeater, Red-knobbed Pigeon, White-bellied Greybird, Crested Hawk (*Aviceda subcristata*), Pied Hawk, and Red and White Eagle-Kite (*Haliastur indicus*).

Although we know most of the birds of Guadalcanal, I believe there may be several that remain to be discovered. I saw a small flock of birds flying through the underbrush in the jungle in a valley just east of Kokumbona. I was unable to observe them closely, but I did notice that their upperparts were a glossy red, or reddish-brown. They were the size of a grosbeak or wood thrush, and sang loud and beautiful warbling songs. I also saw a strange green honeysucker with a half-inch curved bill at an orange blossom on Mount Austin. This last was plainly seen and all its details noted.

The upper forest zone, from 6000 to 8000 feet elevation, has been explored little, if any, by ornithologists. It should be a habitat for species not found at the lower elevations. A fine native trail, which starts from Kole Point and crosses the mountains at an elevation over 6000 feet, should make the exploration of this region fairly easy.

Unless otherwise stated, all the localities mentioned in the following list are on Guadalcanal. The species mentioned are only those about which new information on habitat, behavior and distribution has been obtained.

Table 1

Ornithological Succession in War-torn Jungle on Guadalcanal

Stage 1	Stage 2	Stage 3	Stage 4
Forest open, completely devastated.	Dense underbrush growing in; new foliage appearing on trees.	Open forest; trees crowning out in foliage.	Complete recovery.[1]
Bird life absent. *Aplonis cantoroides* first to enter, followed by *Acridotheres tristis* and *Hemiprocne mystacea*. Dead trees serve as nesting places for *Aplonis* and *Hemiprocne* and as foraging lookout perches for *Eurystomus orientalis*.	This stage is marked by entry of underbrush inhabitants, such as *Monarcha castaneiventris* and *Myiagra ferrocyanea*. Other entries: *Rhipidura leucophrys, Aplonis metallicus, Myzomela melanocephala, Nectarinia jugularis, Dicaeum aeneum, Coracina papuensis, Halcyon chloris, Trichoglossus haematodus, Eos cardinalis.*	Development of foliage leads to entry of forest dwellers:[2] *Megapodius freycinet, Ptilinopus viridis, Ducula rubricera, Vini margarethae, Cacatua ducorpsi, Larius roratus, Geofroyus heteroclitus, Coracina lineata, Pachycephala pectoralis, Mino dumontii.*	Entry of deep shade tolerant species: *Aplonis grandis, Halcyon leucopygia, Rhyticeros plicatus, Rhipidura cockerelli, Cacomantis pyrrhophanus.*

[1] Exact details unknown to writer; observations of untouched jungle and of the new growth lead to the assumption that, at least for a while, the new growth will be more dense.

[2] Species dropping out are *Acridotheres tristis, Aplonis cantoroides, Hemiprocne mystacea, Halcyon chloris, Eurystomus orientalis,* and *Rhipidura leucophrys. Eurystomus* frequents the forest edge.

Phalacrocorax melanoleucus. Little Pied Cormorant. Single birds seen several times on sand bars in the Lunga and Malimbiu rivers.

Butorides striatus. Little Mangrove Heron. Single birds seen in marshes and swamps and along the rivers.

Accipiter albogularis. Pied Hawk. Observed one at the edge of the coconut grove on the east side of the Tenaru River. Saw one gray and white phase individual and one of the gray phase in a banyan in the selva along a stream flowing into the Tenaru. A nest in the same tree was presumably of this

species. A hawk of the gray phase flew into a tree filled with sunbirds and chased them; then it flew into a tree with thick foliage nearby and hid in it, now and then darting out after the sunbirds.

On June 6, 1943, I observed a pair constructing its nest in a venua tree standing apart from a grove of venua in the meadow east of Lunga Roads. The nest was built of sticks and was placed in the crotch of a limb, 20 feet from the ground. Although the hawks started building a few days before June 6, they were still building on July 10. I visited the nest on July 15 and believe it was then about ready for eggs. The nest was the size of a bushel basket; inside, it measured about six inches in depth and ten inches across. Both hawks took part in the nest building, making an average of less than two visits per hour. Each time they came in, they emitted loud cries (a series of "krees") upon landing. Similar cries were given when the birds departed. A new stick was poked in, and then the hawk rearranged the other sticks to make the nest more sturdy.

Records of visitations follow:

	Hours at nest	Visits by hawk
June 8	3	4
June 15	5	8
June 16	4	5
June 17	4	7
June 19	2	0
June 27	3	4
July 3	4	6
July 5	3	4

Each bird over a period of three hours made two visits apiece. However, on June 15 and 17, their visits were more frequent, the birds each making four visits to the nest over a five-hour period on June 15. The female was apparently shot, as I never found eggs in the nest.

Haliaeetus sanfordi. Sanford Eagle. Seen flying over the jungle on two occasions,. A pair lived in the region about the Wright Road on Mount Austin, and I frequently saw them circling high in the sky. I saw one sitting on a high perch on a tree on top of a grassy peak on Mount Austin. It subsequently flew off down over the valley of the Metanikau River. Two eagle-kites were noted attacking a Sanford Eagle over the jungle near the Malimbiu River, The kites were successful in driving the eagle from their territory.

Megapodius freycinet. Megapode. Common on the floor of the jungle. This species has a loud mourning cry resembling, "I'll buy—tobacco!" This is preceded by several turkeylike "kows," after which there is a pause. The birds call on moonlit nights, in the early morning until ten o'clock, and then in the evening from four o'clock until dark.

Turnix maculosa. Spotted Button-Quail. Several seen singly in the fields of kunai grass about the Malimbiu, Berendi, Metapona, Tenaru, and Lunga rivers.

Poliolimnas cinereus. White-browed Rail. A pair was seen feeding in a grassy slough near the mouth of the Tenaru River. On January 31, 1943, I saw two one-inch long, black chicks with them. They followed the mother and she fed them now and then, the chicks taking the food directly from her bill.

Ptilinopus solomonensis. Yellow-bibbed Fruit Dove. Observed one in jungle on Tulagi.

Gallicolumba jobiensis. White-throated Ground Dove. A pair was recorded feeding on the ground near the mouth of the Malimbiu River by Dr. Wm. J. Marsteller. His detailed description, which included mention of a buff breast, enabled me to place it as this species.

Trichoglossus haematodus. Coconut Lory. Very common in the jungle and in the coconut groves, although not as numerous as the Cardinal Lory. Feeds on the nectar of the coconut blossoms. I observed a large flock of about a hundred birds feeding on blossoms of the scarlet bottle brush (*Myrtaceae*) at the edge of the jungle near the Berendi River.

Micropsitta finschii. Pigmy Parrot. Saw several working up trunks of large, smooth-barked trees in the Metanikau Valley. Clinging to the sides, they worked up the trunk in the manner of a creeper, pausing now and then to tear off bits of bark.

Larius roratus. King Parrot. Common in the jungle, where it forages in the tree tops. This species goes about in flocks of up to twelve individuals. It has a wide variety of parrotlike calls, but the

most unusual call notes are two loud, ringing whistles; a grace note, followed by a loud blast, "ke-ahh, ke-ahh." Individuals communicate with each other using this call. I observed nests on two different occasions (April 3 and August 10, 1943). Each one was high above the ground, and was placed deep down beyond reach in a cavity in a limb of a banyan.

Geoffroyus heteroclitus. Song Parrot. Seen in small flocks on Tulagi and observed in the selva (dense forest growth) about the Malimbiu River on Guadalcanal. This bird perches on the topmost branch of a tall tree to sing and will sing for long periods, usually on bright sunny days, although one sang when it was cloudy. It has an unusually large repertoire of notes for a parrot and many of the notes are very melodious.

Cacomantis pyrrhophanus. Fan-tailed Cuckoo. Observed a pair in low jungle on the bank of the Malimbiu River. The birds frequented the lower level of the forest, keeping to the dense shade.

Chalcites lucidus. Shining Cuckoo. Frequently heard during June and July in the depths of the selva. Notes are very ventriloquistic and are a rapid series of whistles resembling a boy calling his dog. A pair was observed feeding in low trees on the banks of the Malimbiu River.

Centropus milo. Buff-headed Coucal. Common in the selva, where the birds forage in the foliage and vines for food. They frequently come down to the ground to feed. I observed one tearing off the bark and bits of wood from a dead limb, most likely searching for beetle grubs. The cries are raucous, and the calls of several at a distance resemble the sawing of wood. At dawn every morning, near my quarters on the Malimbiu, a female coucal flew up on a perch in a breadfruit tree and gave a series of loud "ows." The bird flew to the same perch each time. The call was followed by several low booming hoots that resembled the notes of the crowned pigeon.

Ninox jacquinoti. Boobook Owl. Heard calling from the selva on moonlit nights. One owl hooted from a tall banyan tree just outside my quarters on the Malimbiu every night during the moonlit periods. It had a favorite perch well up in the tree. The first hoots, a series of mournful "oh" notes, were low-pitched. These became higher and higher and gradually louder, developing a two-toned note that began to resemble the whine of a puppy. Then they developed into a louder and harsher "ka," which was repeated and kept up for an hour or so. At times the bird gave a long loud blast resembling the noise made by a cardboard horn at a New Year's party. A second bird joined in soon after the first began, calling at a lower pitch, and the result was a weird duet.

Collocalia spodiopygia. White-rumped Swiftlet. Common hawking over grass-covered foothill ridges of Mount Austin and in areas to the westward.

Alcedo atthis. River Kingfisher. Pair seen on the Malimbiu River. The birds sat on the limbs of a dead tree washed up on a bar and dove into the river for fish. They built a nest in the sandy river bank, 6 feet above the water. Both birds took part in building on August 22, 1943. Notes are a high "teet teet."

Halcyon chloris. White-collared Kingfisher. Common in the coconut groves and the open country. It was seen feeding on lizards, which it hacks to pieces. I watched two nests situated about fifteen feet above ground in the sides of coconut palm trunks. One contained two week-old chicks on December 24, 1942. A common call is a series of high-pitched, loud notes resembling the squeak of a hollow rubber rat; this usually is uttered three or four times. The birds also give a loud, grating cry resembling "racko, racko" and loud, sharp "krees."

Halcyon leucopygia. Ultramarine Kingfisher. Frequents the dense selva, where Mayr (*op. cit.*) states that, "it is a bird of the true forest, usually perched on rather high trees." I saw it commonly about jungle sloughs, where it kept well within the understory, in the dense, shade of the jungle canopy. It utters a flycatcher-like "chew cho tew," which descends the scale, the last note dropping sharply. The birds were seen singly or in pairs. In one pair, a bird flew up to a perch and was followed by its mate. Facing the front, they started bowing, first one bowing, then the other.

Rhyticeros plicatus. Papuan Hornbill. Not rare in the selva, where it was seen feeding on the fruit of banyans. The hornbill flies in formation. The female (?) usually flies on the left side of the male, and, in a flight of four, one leads, two fly abreast, and one brings up the rear.

Coracina lineata. Yellow-eyed Greybird. Not uncommon in the selva. The species goes in small flocks of from 8 to 12, flying from tree to tree, foraging for fruit. They seem to have a leader and depart from a tree by ones and twos, until the whole flock has left. I watched a flock fly through the upper part of the selva, the average time spent in one tree being ten minutes. Then one bird, pre-

sumably the leader, flew out and across to another tree a few yards distant, and the rest of the flock straggled after him.

Acrocephalus arundinaceus. Reed Warbler. Lives in swamps, in grassy fields, and in the low brush along the rivers below the selva. This bird's ability to hide itself in brush only a foot high is remarkable; its movements through vegetation accordingly are difficult to follow. Reed Warblers have a beautiful, repertoire of loud, short vigorous song passages which resemble the song of the New Caledonian Silver-eared Honeyeater, or of the Cardinal. The music is full and throaty; the melody pouring from it like a rippling brook. It is the most beautiful songster I heard in the Solomons and rivals the best heard in the South Pacific. On December 24, 1942, I observed numerous Reed Warblers in a stand of trees resembling holly and with flowers resembling the Myrtaceae that grew in the waters at the mouth of the Tenaru River. They were singing loudly as they fed on the nectar of the orange-colored blossoms.

Myiagra ferrocyanea. Broad-billed Flyatcher. Not uncommon in the understory of all types of forest habitat. It is quite inquisitive and responds readily to an imitation of its song, which is a series of slow "sweets." One was seen singing while in flight; it braked with wings and tail spread, the latter pointed up. Then it reared up to sing a note, after which it darted down, only to repeat the actions for another note.

Aplonis grandis. Brown-winged Starling. Frequents the selva, singly or in pairs, feeding on fruit. Observed after fruit in banyan trees and in a tree laden with tiny fruits outside my quarters on the Malimbiu River. A pair visited the tree twice daily, in the morning about ten, and again in the early afternoon about two. They were frequently there with Colonial Starlings, but the two species never bothered each other.

Aplonis metallicus. Colonial Starling. Frequents the open country and is found in second growth and along the edge of the selva. It travels in flocks of 15 to 40, feeding on small berries and other fruit. Flocks of starlings from a nesting colony near the Malimbiu River flew across the river to visit a tree laden with small fruit. They came about ten in the morning and again in the early afternoon. Another visit was paid the tree just before sundown at six o'clock, when they returned to their nests in a tall mango, the crown of which was fifty feet above the ground. The nests were pendant, with the entrance at the side, and were placed out at the ends of the limbs. There were several separate flocks in the colony, and the birds were engaged in constructing the nests which were in various stages of completion. Both the male and the female took part in the building. In the morning, flocks dispersed in different directions, returning again at sundown. Birds that were not finished building remained to work on the nests. Although the flocks flew as one, on several instances I observed small flocks passing through the jungle in single file, one or two birds at a time, and they seemed to have a leader. The many notes uttered are a series of squeaks, high-pitched whistles, grunts and twanging notes. The birds are very noisy about the nest tree, and when flying about in the close-knit flocks, they utter notes that resemble the hum of a swarm of low-humming bees.

Mino dumontii. Papuan Myna. Fairly common in the selva; also seen in the second growth, although not as numerous. Mynas frequent the tops of the jungle trees where they utter a wide repertoire of whistles, chirps, and other notes. The most striking notes are a series of whistles, running up the scale and another series descending the scale, resembling the sound of harp strings.

Corvus woodfordi. White-billed Crow. Inhabits the selva where it travels in small companies of from three to six. A group of three roosted in a dense grove of mango trees across the Malimbiu River from our camp, arriving at the grove just before sundown, about 5:30 p.m.

Myzomela melanocepala. Solomons Honeyeater. Not uncommon in the selva and lower forest growths along the rivers and in the meadows. On June 18, 1943, I observed a pair of honeyeaters chasing about a grove of venua trees in the meadow near Lunga Roads. Suddenly one of them (presumably the male) went through what probably were courtship actions. He flew back and forth, just in front of the female, which perched on a limb, then landed in front of her and acted like a young bird begging for food, fluttering his wings, and chirping loudly. Then he repeated the flight again, and again landed to go throuh the actions of a young bird.

Dicaeum aeneum. Midget. Common on Guadalcanal and Tulagi where it is found in all habitats. Utters twittering notes resembling the snapping of twigs.

Pullman, Washington, February 1, 1949.

FROM FIELD AND STUDY

California Condors Observed from Airplane.—On October 15, 1949, at 1:30 p.m., the writer caught sight of two very large soaring birds while piloting a two-place Cessna airplane above Liebre Gulch, about 8 miles southeast of Sandberg, Los Angeles County, California, and 26 miles southeast of Mount Pinos. A lookout for Condors had been kept during regular weekly trips over this region since the preceding November, during which time many Turkey Vultures and a few Golden Eagles had been seen but no birds as large as those now sighted. They were soaring at an altitude about 500 feet higher than the plane, the latter registering 5500 feet above sea level. The altitude of the wild and rugged hills at this point reaches 3500 feet as shown on the U. S. Tejon Quadrangle, which placed the birds at 2500 feet above the ground level at that point.

A few seconds after altering course and climbing so as to approach the birds directly, I was able to identify them unmistakably as California Condors. Like Turkey Vultures and eagles these birds, no doubt unaccustomed to being challenged in the air, made much less effort to get out of the way of the plane than do ducks and geese, for example. Such waterfowl alter course quickly, accelerate their wing strokes and, upon close approach, dodge erratically. Turkey Vultures, eagles and Red-tailed Hawks often describe evasive circles on set wings and sometimes flap heavily upon very close approach, but show much less disposition to change course and often make none whatever.

As the plane overtook the Condors from their left, they behaved like other large birds of prey. They sailed to the right in a tight circle on motionless wings so that I was obliged to bank steeply and make a sharp 180 degree turn to avoid running past them on a tangent with the risk of losing sight of them entirely. By keeping in a very steep bank, with the Condors turning on motionless wings within their own smaller circle, the writer reduced the distance to about 100 feet from the closer bird. At this close approach, it stared over its shoulder, flapped heavily and turned still more sharply in its circling so that the plane shot on by, whereupon the bird resumed its leisurely soaring. A second close approach was made similar to the first, with the same sequence of behavior, including the neck craning and laborious flapping when the plane approached within 100 feet.

This incident took place directly in Amber Airway No. 1, which is a straight line between Bakersfield and Los Angeles and is traveled every day by dozens, perhaps scores, of aircraft. Undoubtedly the birds are thoroughly familiar with planes. Their behavior indicated no alarm more acute than that shown by a roadside bird when it flies a few yards out of the way of an approaching automobile.

The cruising speed of this plane is approximately 100 miles an hour, but in climbing and turning maneuvers involved in observing the birds, it was traveling not more than 80 miles an hour. Nevertheless, as is the case with all soaring birds observed thus far, the man-made flying machine overtook them with the speed of an express train. Overhauling birds in flight takes place so rapidly that the chief concern is to stay far enough to one side to avoid collision in case the birds make an unexpected turn. Collision with a Condor could conceivably cause extensive damage to a small plane.—LOWELL SUMNER, *National Park Service, San Francisco, October 26, 1949.*

New Breeding Records for Colorado.—Nestings of the Ring-necked Duck, Western Grebe, White-faced Glossy Ibis, and Snowy Egret in Colorado have never, or only rarely, been reported. While engaged in studies of waterfowl in the San Luis Valley of southern Colorado, April 1 to September 12, 1949, the writer observed numerous instances of nesting in these four species. Brief comments on the literature and on recent observations and collections are made here to help clarify breeding status of these species in Colorado.

Niedrach and Rockwell (The Birds of Denver and Mountain Parks, Denver, 1939:41) considered the Ring-necked Duck (*Aythya collaris*) to be an uncommon migrant in the Denver area. Bergtold (A Guide to Colorado Birds, Denver, 1928:67) and Sclater (A History of the Birds of Colorado, London, 1912:55) reported a similar status for the state as a whole. Apparently no record of its breeding in Colorado has ever been obtained. On June 10, 1949, the writer observed 19 pairs of this duck in the vicinity of Wright's Ranch, approximately 10 miles west of Creede in Mineral County at an elevation of 9000 feet. On the same date a female and a male with enlarged gonads were col-

lected. Both birds were in full breeding plumage. On July 18, 1949, several broods of downy young were noted in the same area. Three broods for which accurate counts were obtained averaged 9.0 young. Photographs were obtained of other broods. Search failed to disclose nests in any instance, so no clutch counts were obtained.

The Ring-necked Duck appears to be a more common migrant in Colorado than formerly supposed. In the San Luis Valley proper, individuals were noted on April 14, 15, and 16, 1949, in three separate flocks of Lesser Scaup Ducks (*Aythya affinis*). J. Frank Cassel reports seeing migrant birds in the spring and fall of 1949 in the vicinity of Fort Collins, Larimer County, in the northern part of the state.

In Colorado the Western Grebe (*Aechmophorus occidentalis*) was regarded by Sclater (*op. cit.* :4) as a rare migrant. Bailey and Niedrach (Auk, 55, 1938:119) reported an observation of 52 birds as an unusual occurrence. Niedrach and Rockwell (*op. cit.* :25) list this species as an uncommon summer resident, but cite no nesting records. Approximately 50 adult birds were regularly observed by the writer during the nesting season of 1949 on the Russell Lakes, 9 miles south of Saguache, Colorado. These shallow lakes are 7580 feet in elevation and are surrounded by extensive hard-stem bulrush marshes. Nine nests were located in one 320-acre study area, only one-third of which might be considered grebe nesting habitat. The earliest laying noted was on May 6; the earliest young, May 22. One adult male and one downy chick were collected. Pied-billed Grebes (*Podilymbus podiceps*) and Eared Grebes (*Colymbus caspicus*) also nested on this study area.

Bergtold (*op. cit.* :80) considered the White-faced Glossy Ibis (*Plegadis mexicana*) to be a rare breeder in Colorado. Sclater (*op. cit.* :77) tells of White-faced Glossy Ibis nests observed in the San Luis Valley by Aiken on July 1, 1875. In 1949, at least 12 pairs were observed nesting in the Russell Lakes study area. The first clutch was noticed on May 22; the first young, June 20. On June 22, Clyde P. Matteson and the writer banded two fledglings and made still and movie photographs of nests, young, and adults. One immature male was collected on July 22.

In recent years, the Snowy Egret (*Leucophoyx thula*) has apparently nested in increasing numbers in Colorado. Bailey and Niedrach (Condor, 40, 1938:44-45) are credited with the first record for the state, a nest found in the Denver area on July 8, 1937. In 1948, two pairs, and in 1949, six pairs, nested at Terry Lake, two miles north of Fort Collins. The writer found this species well distributed throughout the San Luis Valley, with several small colonies located on the bulrush margins of lakes and ponds. The earliest nests located on the Russell Lakes in 1949 were found early in May; the first young were seen on May 30. Twelve fledgling egrets were banded on June 22 and numerous individuals and nests were photographed in the course of the summer. One adult male was collected for a study skin.—Ronald A. Ryder, *Colorado Cooperative Wildlife Research Unit, Colorado Agricultural and Mechanical College, Fort Collins, Colorado, November 17, 1949.*

Xantus Murrelet Captured in a Dip Net.—In February, 1949, I had the privilege of accompanying Mr. J. W. Sefton, Jr., and several other biologists on a short cruise aboard the "Orca" to San Clemente, Los Coronados, and Todos Santos islands off the coast of southern and Baja California. Late in the afternoon of February 23 we anchored close inshore on the lee side of the southern island of the Coronados group. As soon as darkness set in we began fishing for specimens with a dip net and a shallowly submerged electric light. At about 9:45, Dr. Rolf Bolin, who was handling the dip net from the landing stage at the time, caught a rapidly swimming creature that entered the lighted area about two feet below the surface. When he brought it into the laboratory cabin, it proved to be a mature Xantus Murrelet (*Endomychura hypoleuca*). An hour or so later a second bird was caught in the same manner by another member of the party. Both birds were kept captive until the next forenoon when they were released.

The shrill, plaintive whistle of the murrelets was heard frequently throughout the night, but only the two were attracted to the light. Several others were seen swimming on the surface a few yards from the ship, but at such a distance that the submerged light had no attraction for them.—Ira L. Wiggins, *Natural History Museum, Stanford University, California, November 26, 1949.*

Slate-colored Junco in Reno, Nevada.—During a period of abnormally cold weather from January 19 to February 13, 1949, a Slate-colored Junco (*Junco hyemalis*) came at frequent intervals

to eat bread crumbs at a feeding shelter at my home in Reno, Nevada. Since the ground was covered with about four inches of crusty snow, which did not melt appreciably during that time, many Oregon Juncos (*Junco oreganus*) and several English Sparrows (*Passer domesticus*) fed there also. An excellent comparison could be made when both species of junco were feeding together. The Slate-colored Junco, however, would usually chase all other birds away from the shelter and eat alone while the others waited nearby. When warmer weather arrived and the snow melted, the bird was no longer seen.—NED K. JOHNSON, *Reno, Nevada, November 24, 1949.*

Late Nesting Record for the Abert Towhee.—While driving down a dirt road a few miles north of Westmorland, Imperial County, California, on September 16, 1949, we observed an Abert Towhee (*Pipilo aberti*) fly from a small mesquite tree. On examining the tree we found a towhee's nest containing four fresh eggs. The nest was four feet above the ground on an outer branch within a few feet of the road. The nest and eggs were collected and are now no. 1136 in the Cardiff Collection. Mr. W. C. Hanna of Colton, California, who has had much experience with the nesting of the Abert Towhee on the Colorado Desert, has not found them nesting this late.—EUGENE E. CARDIFF and BRUCE E. CARDIFF, *Bloomington, California, November 8, 1949.*

A Sight Record of the Knot in Colorado.—On September 6, 1941, the undersigned stopped at Barr Reservoir, Adams County, Colorado, for the purpose of observing birds. On a bar that extended into the water from the shore was a group of shore birds, mainly Greater and Lesser yellowlegs and Pectoral Sandpipers, but among them was a Knot, *Calidris canutus*. Realizing that the occurrence of this species so far inland was unusual, we carefully observed it through glasses and in good light. We noted that it retained some reddish coloration of the nuptial plumage and, when flushed, gave the characteristic note of the species. We are well acquainted with the Knot, having often observed it about the Great Lakes and along the Atlantic seaboard.

Recently, while examining the manuscript of the revised ranges of the shore birds, which is to be used in the next edition of the American Ornithologists' Union Check-list, our attention was called to the lack of records of the Knot for Colorado. Belatedly, then, we decided to publish this sight record. —MILTON B. TRAUTMAN and MARY A. TRAUTMAN, *Stone Laboratory, Put-in-Bay, Ohio,* and H. G. DEIGNAN, *Smithsonian Institution, Washington, D.C., November 15, 1949.*

The Southern Limits of the Willet's Continental Breeding Range.—Ornithologists interested in the bird life of the coast of the Gulf of Mexico probably have suspected for a long time that the Willet (*Catoptrophorus semipalmatus*) bred farther south than the mouth of the Rio Grande, but so far as I have been able to ascertain no breeding specimen has actually been collected on the coast of eastern Mexico until very recently. As long ago as 1863, H. E. Dresser found the species in summer about "a good-sized lagoon or pond, formerly the main bed of the river" near what was then "one end" of the town of Matamoros, Tamaulipas (Ibis, 1865:312). I believe he did not obtain breeding specimens at that particular pond, although he obtained some at Boca Grande in July. Various persons since that time have taken the bird in summer on the Texas side of the Rio Grande in the vicinity of Brownsville.

On May 9, 1949, C. Richard Robins briefly visited the Tamaulipas coast about 25 miles south of the mouth of the Rio Soto la Marina. There, in the vicinity of the village of Tepehuaje (about 80 miles north of the city of Tampico), he encountered a scattered colony of breeding Willets. He collected one specimen, a female with a fully-formed egg ready for laying. The bird was moderately fat and weighed 357 grams (including the egg). The specimen is now in my collection.

I examined this bird with considerable interest, finding it, somewhat to my surprise, to be closer to *inornatus* than to the nominate, eastern race both in size and color. Since, according to the 1931 edition of the American Ornithologists' Union Check-list, *C. s. semipalmatus* is considered the breeding form of the Texas coast, I re-measured the Tepehuaje specimen, and compared the measurements with those of three birds (two males and a female) from Cameron County, Texas, collected in June, 1930, by H. H. Kimball. The following table presents a comparison of my findings with those of Ridgway (Bull. U. S. Nat. Mus., 50, pt. 8, 1919:316-319).

Measurements of *Catoptrophorus semipalmatus* in Millimeters

	Wing	Tail	Culmen	Tarsus
Males				
Ridgway's average for 10 *semipalmatus*	188	70.6	54.5	56.7
1 specimen from Cameron County, Texas (U.M.M.Z. 66171)	193	74	61	56
1 specimen from Cameron County, Texas (U.M.M.Z. 66172)	195	72	58	62
Ridgway's largest of 10 *semipalmatus*	195.5	74	58	58.5
Ridgway's average for 11 *inornatus*	205.2	79.4	59.4	64.9
Ridgway's largest of 11 *inornatus*	218	84.5	63.5	69
Females				
Ridgway's average for 5 *semipalmatus*	187	70.1	56.2	55.1
Ridgway's largest of 5 *semipalmatus*	191	74	59	58
1 specimen from Cameron County, Texas (U.M.M.Z. 66173)	200	79	59	60
1 specimen from Tepehuaje, Tamaulipas (Sutton Collection)	204	76	65	63
Ridgway's smallest of 6 *inornatus*	209.5	74	63	66.5
Ridgway's average for 6 *inornatus*	213.5	80.9	64.1	68.3
Ridgway's largest of 6 *inornatus*	220	88	65	70

The bill length of the female from Tepehuaje, Tamaulipas, is exactly that of the longest-billed *inornatus* measured by Ridgway. Its tail length is greater than the shortest-tailed female *inornatus* measured by Ridgway. Its wing length and tarsus length fall between those of the largest *semipalmatus* and smallest *inornatus* measured by Ridgway, but are actually closer to Ridgway's average for *inornatus* than to that of *semipalmatus*. In size, then, we must call the Tepehuaje specimen *inornatus*.

The Cameron County birds appear to be intermediate between the two races in size, with a definite tendency toward *inornatus* evinced particularly in the female's tail length, which is almost as great as that of Ridgway's average for *inornatus*. In wing length and tarsus length also, this female bird is definitely large for *semipalmatus*, and its bill length equals that of the longest-billed *semipalmatus* measured by Ridgway. The male birds too are consistently very large for *semipalmatus*, only one measurement of the eight (tarsus length of U. M. M. Z. 66171) falling at all below Ridgway's average for the eastern race. On the basis of the above, I maintain that it is a mistake to call birds from Cameron County, Texas, *semipalmatus* without qualifying the statement. Assuredly they tend toward *inornatus* in size.

In color, the female from Tepehuaje, Tamaulipas, is obviously much paler both above and below than the birds from Cameron County, hence on a second count must be called *inornatus*. The Cameron County specimens are very similar in color to some *inornatus* in the series of breeding specimens in the University of Michigan Museum of Zoology, but on the whole they seem too heavily marked with black both above and below for that race.

More specimens must, of course, be collected along the coast of southern Tamaulipas before we can be certain that the whole breeding population there represents the western race. *Catoptrophorus semipalmatus inornatus* has heretofore been considered a bird of the interior. Further investigations may reveal, however, that there is a clinal trend toward largeness and paleness from the Texas coast southward. How much farther south than Tepehuaje, Tamaulipas, the Willet breeds is a question. Robert B. Lea, who visited the Tampico region in late May, 1947, informs me that he did not record the species there. Should the Tamaulipas population prove distinct from both *inornatus* and *semipalmatus*, the name *speculiferus* Cuvier apparently is available (Hellmayr and Conover, Cat. Birds Amer., part 1, no. 3, 1948:129).—GEORGE MIKSCH SUTTON, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan, August 3, 1949.*

The Brown Pelican as a Scavenger.—On the afternoon of November 27, 1949, the research ship "Orca" of the J. W. Sefton Foundation was running in to San Diego from South Coronado Island. We had on board a large porpoise which was being dissected and fleshed. As all waste matter was thrown overboard as removed from the skeleton, the usual accumulation of hungry gulls was following the ship, screaming and fighting over every piece of viscera and flesh that hit the water. Among the gulls were three Brown Pelicans (*Pelecanus occidentalis*) which, to the surprise of everyone on board the ship, joined the gulls in their scramble for this waste. The pelicans did not dive but landed

on the water, bills open and wings held high, and fought with the gulls over chunks and strips of porpoise. In many cases they would flap and paddle right over one or more of the gulls to get at the meat and often took from the gulls large pieces which the gulls could not carry away or swallow quickly.

Prior to this time I had never known pelicans to act as scavengers, but their procedure in this case precluded any possibility that they mistook the refuse for live fish.—J. W. Sefton, Jr., *San Diego Society of Natural History, San Diego, California, December 1, 1949.*

Records of the Knot in the San Joaquin Valley, California.—A detailed survey of the available literature indicates that the Knot (*Calidris canutus*) has not been recorded for interior Oregon, Nevada, or California. Grinnell and Miller (Pac. Coast Avif. No. 27, 1944:150) give the geographic range in California as: "From one end of State to other, but strictly coastwise." Therefore, the following observations made about 65 miles inland from the Pacific coast should be of especial interest.

On August 2, 1949, Daniel W. Slater and I observed a rather compact flock of 60 to 65 Knots, still in breeding plumage, at the edge of a shallow pool in a grassy pasture about 2½ miles northeast of the town of Los Baños, Merced County, California. Some of the Knots were feeding with Avocets and Black-necked Stilts, but most of them were on a slightly elevated grassy area at the edge of the water in one inactive group. Later on this same date, in irrigated countryside, we also observed a similar flock of 15 Knots at the edge of a pool of seepage water in a grassy pasture. This site was near Mendota Pool, just northeast of Mendota in Fresno County. This smaller flock was observed an airline distance of about 33 miles from the larger flock seen four and one-half hours earlier.

Worthy of special note is the fact that both flocks were in breeding plumage and were observed in similar habitat, although these habitats are different than, and inland from, those previously recorded in the literature.

Perhaps shorebird observers have overlooked a major fall migration route of this species in California, since the large numbers noted in this instance indicate more than just accidental use of the San Joaquin Valley.—Fred G. Evenden, Jr., *Fish and Wildlife Service, Sacramento, California, December 10, 1949.*

Nesting Record of the Vermilion Flycatcher in the Northern Mohave Desert.—On May 14, 1949, a male Vermilion Flycatcher (*Pyrocephalus rubinus*) was seen in Indian Wells Valley, northeastern Kern County, California. The observation was made on the old Stayer Ranch about five miles northeast of Inyokern at an elevation of 2300 feet. The ranch is now part of the United States Naval Ordnance Test Station, China Lake. A thorough survey of the ranch area on May 21 revealed that the male flycatcher was mated and that the female was incubating a clutch of three eggs. The nest, which was set in a horizontal fork near the lower periphery of the crown of a locust tree, was constructed mainly of course twigs. The lining consisted of plant fibres, string, soft paper and small leaves, all of which were also interspersed throughout the bowl.

Upon examination of the nest on May 31, only two eggs were found. Resting on the fork in which the nest was set was a stone weighing 22.9 grams, which I am quite certain was not there on the 21st. It was suggested to me that this might be the work of a pack rat. During the evening of June 2 and throughout the next day, a wind storm swept the desert area. According to the Aerology Office of the Naval Air Facility, N.O.T.S., gusts of whole gale velocity (58 m.p.h.) were recorded. It is possible that the nest of the flycatchers could not withstand winds of such intensity, for it was gone on June 5. However, inasmuch as the nest was located in a tree adjacent to a picnic area, its disappearance might well be attributed to vandalism. A male flycatcher was observed in the ranch area on July 25 but on five other visits between June 10 and August 6, when attempts were made to locate a second nest, neither the male nor female was seen.

According to the summary by Grinnell and Miller (Pac. Coast Avif. No. 27, 1944:264) of the distribution of the Vermilion Flycatcher, the breeding metropolis is in the Colorado Desert below 500 feet elevation. More recently, Jaeger (Condor, 49, 1947:213) reported that this species was known to breed near Camp Cady, San Bernardino County, California. The present record extends the breed-

ing range of the Vermilion Flycatcher still another one hundred miles to the northern limit of the Mohave Desert.—WILLIAM R. FISH, *China Lake, California, October 3, 1949.*

Virginia Warbler Parasitized by Cowbird.—The restricted range and elusiveness of the Virginia Warbler (*Vermivora virginiae*), together with its well-hidden nest, probably account in a large measure for the fact that it has so long escaped inclusion in Herbert Friedmann's extensive lists (The Cowbirds, 1929; Auk, 60, 1943:350-356; Auk, 66, 1949:154-163) of birds known to be parasitized by the North American Cowbird, *Molothrus ater*. I am able to add it to the list through the cooperation of Robert J. Niedrach, who took me to the nest of a Virginia Warbler in Daniels Park, near Denver, on July 13, 1949. When Niedrach found the nest in a bunch of grass at the edge of a clump of mountain mahogany (*Cercocarpus parvifolius*) about two weeks earlier, it had contained several eggs of the warbler and one cowbird's egg. At the time of our visit, however, it was occupied by only one weak little warbler almost smothered beneath a lusty young cowbird.

The cowbird involved was *Molothrus ater artemisiae* which, with the addition of the Virginia Warbler to Friedmann's lists, is now known to parasitize 110 species and subspecies.—FRANK C. CROSS, *Silver Spring, Maryland, September 26, 1949.*

A Vireo Specimen with Supernumerary Rectrices.—There are few records in the literature of passerine birds with supernumerary rectrices, although Arthur A. Allen informs me that they are not uncommon in the Ruffed Grouse (*Bonasa umbellus*) and perhaps in other gallinaceous birds. It may be of interest, therefore, to record such an occurrence recently discovered in a specimen in the Louis Agassiz Fuertes Memorial Collection at Cornell University. The bird (C. U. 15791) is a male Carmiol Vireo (*Vireo carmioli*) of undetermined age, collected by Austin Paul Smith at 9000 feet elevation on Volcan Turrialba, Costa Rica, on November 24, 1922. The specimen seems perfectly normal in all respects, save that it possesses no less than fifteen rectrices. All are fully grown, with no trace of sheathing at the bases of the feathers. The three extra feathers are, morphologically, of the type of the normal central pair, with the rachis centrally located. As far as can be determined without damaging the specimen, the follicles have been duplicated laterally rather than dorsoventrally, thus making it difficult to ascertain precisely which three of the five "central" rectrices are the supernumeraries. The exact stage of development at which this duplication arose is, of course, purely conjectural.—KENNETH C. PARKES, *Laboratory of Ornithology, Cornell University, Ithaca, New York, October 17, 1949.*

Summer Range of the Scissor-tailed Flycatcher.—In connection with other field work in Mexico in the summer of 1949, an effort was made to determine the southern limits of the summer range of the Scissor-tailed Flycatcher (*Muscivora forficata*). On July 18, careful check was made of the occurrence of this bird along the highway between Matamoros and Ciudad Victoria, Tamualipas. Several Scissor-tails were observed in the vicinity of Santa Teresa; one at Las Norias (104 miles by road SSW Matamoros); and two near Tres Palos (about 25 miles NNE Jimenez). Beyond this point no Scissor-tails were encountered. Since mid-July is within the breeding season as reported by Bent (Bull. U. S. Nat. Mus., no. 179, 1942:92), it is likely that the birds here reported were within their breeding range. This point needs confirmation, however.—W. B. DAVIS, *Department of Wildlife Management, College Station, Texas, October 3, 1949.*

Mallards "Mobbing" Cooper Hawks.—Late in the afternoon of September 30, 1949, while studying Coots (*Fulica americana*) on Lake Temescal, on the eastern edge of Oakland, Alameda County, California, I observed behavior of about 20 Mallards (*Anas platyrhynchos*) and six Coots which seemed to be comparable to the "mobbing" behavior so well known among passerine birds. Two Cooper Hawks (*Accipiter cooperii*) were the objects of this demonstration.

About 5:15 p.m. a Cooper Hawk sailed across the lake, causing some uneasiness among the widely scattered waterfowl. The hawk showed no interest in any of them but flew into a large oak and a moment later emerged closely pursuing another larger and paler Cooper Hawk. In close pursuit they flew into another group of oaks which partly overhang the west shore of the lake. Here the first bird was seen to engage in some sort of a tail-spreading display, apparently for the benefit of the other

hawk. After this had continued for about two minutes, I noticed that most of the Mallards on the lake were moving to the water directly under the hawks, and once there, the ducks proceeded to mill around silently. Soon several of the nearby Coots moved over to join the outer ranks of the Mallards. Once the displaying hawk paused long enough to make a sudden pass at the accumulated waterfowl, quickly scattering them. But the water birds were back in a group again almost before the hawk was back on its perch. The Coots were making some of their distinctive noises and exhibiting their characteristic warning display as they moved around the edge of the milling ducks.

Finally after some 15 minutes of this, the larger hawk flew directly across the lake. It left the tree in level flight and caused no major reaction among the waterfowl. When its companion left the tree, however, it swooped low over the assembled birds, causing the six Coots to dive simultaneously and the Mallards to churn the water as they scrambled for safety. The hawk showed no intention of securing a bird and flew directly on across the lake. With the departure of the raptors the ducks and Coots soon returned to the various parts of the lake to carry on their normal activities.

I wonder if this congregating of Mallards near the perch of a possible predator might not be comparable to the flocking behavior of Coots when under attack by Bald Eagles.—GORDON W. GULLION, *Museum of Vertebrate Zoology, Berkeley, California, October 30, 1949.*

A New Clapper Rail from the Territory of Quintana Roo, Mexico.—During a recent expedition in the Territory of Quintana Roo, Mexico, for the Peabody Museum of Natural History at Yale University, I was fortunate to collect two Clapper Rails. One individual taken at Vigia Chico, an abandoned town on Ascension Bay, proves to be the second known specimen of *Rallus longirostris pallidus* Nelson, the type of which was collected at Rio Lagartos, Yucatan, in 1893. My second specimen, which was collected while on a short trip to Chinchorro Bank, a group of islands about twenty-five miles off the southern end of the Territory, appears to belong to a new race for which I propose the name

Rallus longirostris grossi new subspecies

Type.—Adult female, no. 8113, Peabody Mus. Nat. Hist., collected at Cayo Centro, Chinchorro Bank, Territory of Quintana Roo, Mexico, February 4, 1949, by Raymond A. Paynter, Jr.

Diagnosis.—Bill shorter than that of any known race. Nearest to *pallidus* of the mainland of the Yucatan Peninsula, from which it differs in having the neck and breast more richly colored, near, but darker than, vinaceous-buff of Ridgway, the underside of the neck more dusky, the flanks decidedly darker but with similar barring. The crown and hindneck are much darker brown, the loral and auricular regions darker gray, the neck and back more dusky with the centers of the feathers much darker, verging toward Ridgway's clove-brown, and with the edges darker gray. The primaries are deeper brown and the under-wing coverts are darker. From *belizensis* of British Honduras this race may be distinguished by a much shorter bill, shorter wings and paler centers to the dorsal feathers. The soft parts of this specimen are noted on the label as: "Culmen horn-color, tomia bright orange; mandible orange; legs mixed grayish-horn and bright orange."

Measurements

	Exposed culmen	Wing (not flattened)*	Locality
grossi ♀	48.5 mm.	133.5 mm.	Cayo Centro, Chinchorro Bank, Quintana Roo.
pallidus ♂	50.5	139.0	Vigia Chico, Quintana Roo.
pallidus ♀	53.0	143.0	Rio Lagartos, Yucatan.
belizensis ♀	57.0	141.5	Ycacos Lagoon, British Honduras.

* The wing was not flattened in taking the measurements of my two specimens in order to make a comparison with Oberholser's published measurements of the types of *pallidus* and *belizensis* (Proc. U. S. Nat. Mus., 84, 1937:335, 336).

Range.—Probably confined to the islands of Chinchorro Bank, Territory of Quintana Roo, Mexico.

In spite of the lack of adequate comparative material and the known variation in the populations of the Clapper Rail, I feel justified in describing this new race because of its striking characters and its geographic isolation.

This rail was not uncommon on Cayo Centro, as Griscom also reported (Amer. Mus. Novit. No. 236, 1926), but the shy nature of the bird and the shortness of my visit did not permit the collection of additional specimens.

I take great pleasure in naming this race in honor of Dr. Alfred O. Gross, a distinguished student of North American birds and a stimulating teacher and friend. I am indebted to Messrs. James L. Peters of the Museum of Comparative Zoology and Emmet R. Blake of the Chicago Natural History Museum, who have kindly compared my specimens with the types of *belizensis* and *pallidus* in their respective collections.—RAYMOND A. PAYNTER, JR., *Osborn Zoological Laboratory, Yale University, New Haven, Connecticut, January 15, 1950.*

A New North American Record for the Tufted Duck.—On May 24, 1949, Mr. Harold P. Deutschman of Livermore, California, presented the California Academy of Sciences with a mounted specimen of a duck which he described as a "freak scaup with a crest on its head." He had shot the bird some time between December 23, 1948, and January 8, 1949, at a pond on the property of the Henry J. Kaiser Gravel Plant in the Livermore Valley, Alameda County, California.

On examination the specimen in question (now Calif. Acad. Sci. no. 61012) proved to be a male Tufted Duck (*Aythya fuligula*), a fairly common Palearctic species which, heretofore, has been recorded only from Greenland and the Pribilof Islands in the New World. Although there is always the possibility that this individual might have escaped from a local aviary, the species is reported to be rare in captivity in North America. Mr. Jean Delacour of the American Museum of Natural History, who is very familiar with captive waterfowl in this country, informed the writer in October, 1949, that he was unaware of any captive Tufted Ducks in the western United States. It is probable, therefore, that this individual was an aberrant migrant from northeastern Asia where the species is known to breed.—ROBERT T. ORR, *California Academy of Sciences, San Francisco, California, January 3, 1950.*

Notes on the Ecological Distribution of Plain and Bridled Titmice in Arizona.—The Bridled Titmouse (*Parus wollweberi*) ranges northward from the Mexican highlands into southeastern Arizona where it is a permanent resident in the oaks, whereas the Plain Titmouse (*Parus inornatus*) is a "permanent obligate resident of the pigmy conifers" in northern Arizona (Woodbury and Russell, Bull. Univ. Utah, 35, 1945:93). Ranges of the two species overlap where their respective habitats meet or intergrade south of the Mogollon Plateau in the east-central part of the state. Specimens in the Museum of Vertebrate Zoology show that during the nesting season this zone of overlap extends at least from Stanley, Graham County, north to the Sierra Ancha. The two species were observed together in two localities in the spring of 1949 and, since their nesting requirements are similar, an effort was made to see if they competed and if not, by what means competition was avoided or reduced.

At Sawmill, 27 miles northeast of Globe, Gila County, observations were made from April 22 through 25, 1949. Here, at an elevation of 5600 feet, occasional pairs of the Bridled Titmouse were found in a woodland of junipers and gray oak (*Quercus grisea*) 10 to 12 feet in height, with taller yellow pines scattered throughout. On an opposite sunny slope, the oaks and junipers appeared to be more widely spaced with yellow pine absent. Here W. C. Russell took one Plain Titmouse and saw another within 75 yards of a pair of Bridled Titmice. I did not note the Plain Titmouse on that slope in the course of three hours of hunting there the following morning. Twice in this vicinity I noted other isolated pairs of Bridled Titmice in small areas of presumably more favorable habitat.

At a camp (April 27-29) 8 miles south of Whiteriver, Navajo County, at an elevation of 6100 feet, the Plain Titmouse was met frequently in a woodland of juniper, piñon, and gray oak. Occasionally pairs of the Bridled Titmouse were encountered locally in this woodland where the scrubby oaks were more numerous and denser. Presence of the Spotted Towhee (*Pipilo maculatus*) was an indication of the vegetation density of those areas to which the Bridled Titmouse appeared restricted, whereas the towhee did not occur in the more open parts of the association where the Plain Titmouse was found exclusively. This condition obtained at both localities visited, but at the latter, the more abundant Plain Titmouse penetrated the denser oak growth to some extent. While both species appeared to have territories established there, I found none overlapping; on one shallow, east-facing slope, a linear sequence of Bridled, Plain, and Bridled territories occurred in what appeared to be uniform habitat of the Bridled Titmouse. In one instance song of a Bridled Titmouse was answered by that of the Plain.

Although no female Bridled Titmice were taken, observations were made which suggest that the nesting cycle of the Plain Titmouse may have been in advance of that of its relative. Plain Titmouse

females were incubating, while a female examining a cavity in an oak limb was the only evidence of nesting activity which I saw in the Bridled Titmouse.

The average weight of seven males of *inornatus* from southern Arizona is 15.5 grams, that of four males of *wollweberi* from the same localities is 10.4. These data were all gathered within the period from April 22 to 29, 1949. The difference suggests that the latter species may be able to use smaller cavities for nesting. The size factor may be reflected in foraging preferences as well (Lack, Ibis, 1944:280), a further mechanism by which competition can be reduced, if not avoided.

Relationships between these two species in areas where they occur together during the breeding season need further study, which I hope may be stimulated by these remarks.—KEITH L. DIXON, *Museum of Vertebrate Zoology, Berkeley, California, February 1, 1950.*

An Albino Murre.—In the last week of August, 1949, an oil-soaked, but living albino Murre (*Uria aalge californica*) was found on the shore at Dillon Beach, Marin County, California. The bird was found by Mr. Jack Copsey of the Pacific Marine Station and sent to me in Stockton. It died en route, but when examined the bill was noted to be much lighter than that of typical murres and the feet and eyes were pink. No dark feathers were found after the bird had been washed in carbon tetrachloride to remove the oil. The bird, a female, is now number 794 in the collection of the author.

Dr. Robert W. Storer of the Museum of Zoology of the University of Michigan has studied this murre and is of the opinion that the measurements and the form of the bill indicate that it was a bird of the year. Dr. Storer also commented that it is the only albino specimen of the species that he has seen.—JOHN R. ARNOLD, *College of the Pacific, Stockton, California, February 27, 1950.*

The Starling in Glenn County, California.—On January 18, 1950, I observed a flock of approximately twenty Starlings (*Sturnus vulgaris*) one mile southwest of Willows, Glenn County, California. Several were feeding in a pasture with Western Meadowlarks while the rest were perched on a telephone wire. I was accompanied by Jack Hiehle of the California Division of Fish and Game. On January 25, 1950, Hiehle observed four Starlings one mile north of Hamilton City, Glenn County, feeding in a field with meadowlarks.

These records supplement the others from California that have been published in The Condor: Tule Lake, Siskiyou County (1942); Death Valley, Inyo County (1947); Chino, San Bernardino County (1947); Colorado River Valley (1948); Leevining, Mono County (1948); Grey Lodge Refuge, Butte County (1949); and Point Reyes, Marin County (1949).—FRED L. JONES, *California Division of Fish and Game, Chico, California, January 29, 1950.*

NOTES AND NEWS

Fig. 25. W. Lee Chambers, Business Manager of the Cooper Ornithological Club and member since August 28, 1897.

THE MEXICAN CACIQUE

Grayson's name for the Mexican Cacique (*Cassiculus melanicterus*) was Double-crested Oriole. It is a species that ranges from Sinaloa to Chiapas along the Pacific coast of México. His painting of it was based on specimens taken in January, 1867, on the Río Mazatlán, Sinaloa. The following are excerpts from his manuscript account of the species: The "long pendant nests . . . may often be seen . . . suspended in the air and moved by the slightest breeze . . . . They appear to be loosely put together, admitting the air to pass freely through them, not unlike a net hammock . . . . At first I was at a loss to determine how the bird first made a foundation from the tip end of a slender branch from which [the nest] swings. In due time, however, I was favored with an opportunity of witnessing the *modus operandi*. A long, slender pendant twig is generally selected, often without leaves and at the extreme end of which she fastens, by the aid of her bill and feet, the end of the longest and toughest grass, or [other] suitable material she can find, leaving one end to hang loosely below. After tieing a number to the twig so as to give proper strength to support the structure, she then commences at the lower end and fastens them together in various knots and loops, her acute bill playing back and forth equally as rapid as a kitting needle in the hands of our grandmothers. After the ends are well knit together, and a warp is formed, then commences the operation of weaving in the filling. This is done with astonishing dexterity, the bird keeping inside all the while and keeping the aperture free from entanglement at the same time working and binding the edges of the doorway to prevent it from becoming tangled or closed.

The Double-crested Oriole does not commence to build its nest until after the first showers of June, when all nature seems to become suddenly awakened from a long torpor of drought. Then it is they soon pair off and become very active and garrulous in their delightful task of nidification; then their finely contrasted plumage of black and bright yellow may be seen flitting among the trees, and their oft repeated attempts at song enliven the woods."

The frontispiece showing Mexican Caciques was generously provided for by Mr. and Mrs. Wilson C. Hanna.

PUBLICATIONS REVIEWED

TRAPPING METHODS FOR BIRD RINGERS. By P. A. D. Hollom. British Trust for Ornithology Field Guide No. 1, 40 pp., 24 figs; paper; 2 shillings, 6 pence.

Bird banders and students of bird populations generally have long felt a need for more effective methods of obtaining birds. While this manual presents mostly types of traps found in the Manual for Bird Banders, there are some not found there, particularly those of the large multiple-catch variety. For the student of territorial birds who is interested in a small, easily constructed, one- or two-cell trap, this booklet has little to offer. The Potter type trap described has projecting runners for the doors which would make the trap most unwieldly in brush areas and the treadle is in an awkward position. A noteworthy suggestion is the use of clear plastic for the rear wall of the trap. In most instances the fine points of construction are left to the builder, a fact somewhat disconcerting to the non-mechanically minded person. This manual serves to emphasize the need for new ideas in small trap construction while serving as an excellent supplement to the United States Fish and Wildlife Service's Manual. —HENRY E. CHILDS, JR.

COOPER CLUB MEETINGS

ANNUAL MEETING

The Twenty-first Annual Meeting of the Cooper Ornithological Club held at the Asilomar Conference Grounds in Pacific Grove, California, was unusually well attended. There were 125 members and guests present. Registration began at 9:00 a.m. in Class Hall on April 14, 1950, and at 9:45 the conference was opened with an address of welcome by Junea W. Kelly, President of the Northern Division, and a response from Kenneth E. Stager, President of the Southern Division.

Following a short business meeting, the program of scientific papers began. The complete list of papers for the morning and afternoon sessions of Friday follows:

The Analysis and Interpretation of Avian Hybrids, Charles G. Sibley; Twenty-four Life Areas of Southeastern Arizona, Herbert Brandt; Food Habits Analysis of a Small Group of Shorebirds, William G. Reeder; Shorebird Census on Bay Farm Island, Junea W. Kelly; An Ancient and Probably Ancestral Wader from Patagonia, Hildegarde Howard; The Traditional Recognition of Predators by Game Birds, A. O. Ramsay and John E. Cushing; Status of the Valley Quail in Central California, Ian I. McMillan; Jays and Deer on the Hastings Reservation, P. Quentin Tomich and Jean M. Linsdale; Relations between Birds and Deer, Thane Riney; The History of the Brown and Abert Towhees, John Davis; Preliminary Report on Population Studies of the Brown Towhee, Henry E. Childs, Jr.

Papers presented on Saturday were as follows: The Effect of Humidity on the Metabolic Rate of the House Finch, William Salt; Some Preliminary Observations on Respiratory Water Loss in Birds, William R. Dawson; Some Experiments on the Hormonal Control of the Incubation Patch, Robert E. Bailey; The Reactions of the Poor-will to Temperature and Light, Joseph Brauner; An Analysis of a Rare Duck Hybrid, Henry E. Childs, Jr.; A Recurring Aberrant Color Pattern in the Heermann Gull, George A. Bartholomew, Jr.; Ecological Distribution of Plain and Bridled Titmice in Arizona, Keith L. Dixon; Further Observations on the Flightless Auk, Mancalla, Loye Miller and Hildegarde Howard; Food Relations in the Hawaiian Honey Creepers, Paul H. Baldwin; Observations on the Lawrence Goldfinch, Jean M. Linsdale; Airborne Food of Birds, Roland Case Ross (by title only); Interbreeding of the Red-breasted and Red-naped Sapsuckers, Thomas R Howell; Notes on Taxonomic Principles and "Differentiation Centers" in the Southwest, Allan R. Phillips; New Data on Distributional Patterns in the Santa Barbara Islands, Alden H. Miller; Further Observations on the Crows of Rancho la Brea, William R. Dawson.

At the afternoon session, members took cognizance of the loss of Dr. Louis B. Bishop, Honorary Member and eminent senior ornithologist of the Club. A resolution of sympathy was sent to Mrs. Bishop.

On Saturday evening Mrs. Kelly, as master of ceremonies, called attention to some of the Cooper Club's publications on the lighter side, such as The Buzzard, some of the "illustrated" menus of past Cooper Club banquets, and the history of the Cooper Club written by Harry Swarth. She also introduced the group to "The Indoor Bird Watchers Manual," reading a number of "field identifications" from this delightful satire. Lois Chambers Taylor presented excellent Kodachrome slides of many of the choicest of the Grayson paintings and gave an interesting discussion of Andrew Jackson Grayson himself. This was followed by motion pictures in color taken by Ed N. Harrison and Frances F. Roberts at George Island, Gulf of California, showing exceptionally fine views of many of the nesting sea birds there.

Two field trips were made on Sunday, April 16: a boat trip off shore from Monterey, to see birds of the open ocean, and a land trip along the coast to observe sea otters (in the morning) and to visit the site of the proposed State Park at the mouth of the Carmel River (in the afternoon). The Pacific Grove Museum and the Hastings Reservation also kept open house for Cooper Club visitors.

BUSINESS MEETING

The first session of the annual business meeting of the members of the Cooper Ornithological Club was called to order by President Alden H. Miller in Class Hall, Asilomar, Pacific Grove, California, at 10 a.m., April 14, 1950.

The minutes of the meeting of 1949 were read and approved. Dr. Miller appointed the following committees: to examine the proxies, Kenneth E. Stager, Keith Dixon, and Thomas Howell; to nominate members of the Board of Directors, Stanley Jewett, Charles Sibley, and Lois Taylor.

The following applications for membership were read by the Secretary: Henry William Bushwitz, 2218 S. Baker St., Santa Ana, Merlin L. Killpack, Roosevelt, Utah, and Dr. Fred A. Glover, Wildlife Management, Humboldt State

College, Arcata, California, by Mary M. Erickson; S. J. Darcus, Box 2206, R. R. 1, Penticton, B. C., by John B. Hurley; Lynn Foree, M.D., 379 30th St., Oakland 9, and Mrs. Eve Foree, 266 Lenox Ave., Oakland 10, by Louise Kellogg; Leslie N. Goodding, Fort Huachuca, Ariz., and Olof Charles Wallmo, Fort Huachuca, Ariz., by John T. Wright; Clyde P. Matteson, 1121 North 16th St., Grand Junction, Colo., by C. V. Duff.

The second session was called to order by Dr. Miller at 9:15 a.m. April 15, 1950. Mr. Stager, chairman of the proxy committee, reported that of a total of 1227 members in good standing, 656 were represented by proxies and 100 were present in person. A motion from the floor was proposed, seconded and carried that a quorum be declared present.

The Secretary read a resolution approved by the Board of Directors amending Section 4 of Article VI of the By-laws with respect to the number which should constitute a quorum for the transaction of all business. The change provided for the substitution of "twenty-five per cent of the total existing membership" for "a majority of the existing membership" as a requirement for a quorum. Mr. Duff moved that this resolution be adopted and the motion was seconded. Following a brief discussion, the motion was carried, the secretary being instructed to indicate one negative vote contained in a proxy received.

Mr. Duff, Assistant Business Manager, presented a brief report of the financial condition of the Club and invited any member who wished more detailed information to review the auditing committee's report and other records at his leisure.

Mr. Sibley, reporting for the nominating committee, presented the following names for nomination to the Board of Directors: C. V. Duff, W. I. Follett, Ed N. Harrison, Hildegarde Howard, Jean M. Linsdale, Alden H. Miller, J. R. Pemberton, Sidney B. Peyton, W. J. Sheffler. It was moved, seconded and carried that the nominations be closed and that the Secretary be instructed to cast a unanimous ballot for those named.

Two additional names were read as applicants *for membership: Fred T. Hall, Davenport Public* Museum, 704 Brady Street, Davenport, Iowa, and *Merrill C. Hammond, Lower Souris Refuge,* Upham, North Dakota, both by C. V. Duff.—HILDEGARDE HOWARD, *Secretary.*

SOUTHERN DIVISION

JANUARY.—The regular monthly meeting of the Southern Division of the Cooper Ornithological Club was held January 31, 1950, at the University of Southern California, Los Angeles, with 160 members and guests present. The following names were proposed for membership: Christine Bielfeldt, 924 W. 55th St., Los Angeles 37, Calif., by D. E. Groner; Thomas C. Breer, 15600 Windmill Pt. Dr., Grosse Point 30, Mich., by K. E. Stager; Tom Cade, Box 626, College, Alaska, by J. McB. Robertson; Herbert Hall Caswell, Jr., 10801 Strathmore Dr., Los Angeles 24, Calif., by W. R. Dawson; Ben Chaffey, Box 1877, Stanford, Calif., by A. H. Miller; William Henry Cleary, 233 N. Rexford Dr., Beverly Hills, Calif., by S. Paul Lindau; Ned Keith Johnson, 624 Lake St., Reno, Nev., by Benjamin H. Banta; Wm. Wallace Mein, Jr., 315 Montgomery St., San Francisco, Calif., and William Wallace Mein, III, 315 Montgomery St., San Francisco, Calif., by Wilson C. Hanna; Robert Treat Paine, III, 2 Hubbard Park, Cambridge 38, Mass., by James L. Peters; Jack Quaglino, 14330 Sunset Blvd., Pacific Palisades, Calif., by W. J. Sheffler; Marvin Schwilling, 1002 Peterson, Fort Collins, Colo., by R. G. Beidleman; Robert James Smith, 1971 47th Ave., San Francisco 16, Calif., by F. A. Pitelka; Howard Robert Attebery, 1162 Barcelona Dr., San Diego 7, Calif., Frank C. Cross, 9413 2nd Ave., Silver Spring, Md., Edward Hick, 1126 So. 18th St., St. Louis 4, Mo., and Dale T. Wood, 124 So. "N" St., Lompoc, Calif., by Sidney B. Peyton; Lucia Relf Durand, 640 Middlefield Rd., Palo Alto, Calif., Wallace Grange, Sandhill Game Farm, Inc., Babcock, Wis., Hugh Hanson, Arizona State College, Tempe, Ariz., Jay N. Holliday, 13920 Gilmore St., Can Nuys, Calif., Elizabeth Howe, 1843 N. Cherokee, Hollywood 28, Calif., Jack Lynch, 926 Halladay, Santa Ana, Calif., Margueritte D. Parker, 821 N. Garfield, Alhambra, Calif., Leo Pinkas, 936½ Hermosa Ave., Hermosa Beach, Calif., Mary Ellen Warters, 5115 Woodland Ave., Des Moines 12, Iowa, Dudley F. Wallace, 700 Main St., St. Joseph, Mich., and Ralph B. Williams, Box 2354, Juneau, Alaska, all by C. V. Duff.

C. V. Duff reporting for the Nominating Committee, re-nominated the incumbent officers. The following officers were duly re-elected: Kenneth E. Stager, president; Wilson C. Hanna, first vice-president; W. J. Sheffler, second vice-president; and Dorothy E. Groner, secretary.

"Savage Splendor," a motion picture of birds and animals of Africa, was shown through the courtesy of Bill Lasky and R.K.O. Studios.—DOROTHY E. GRONER, *Secretary.*

For Sale, Exchange and Want Column—Each Cooper Club member is entitled to one advertising notice in any issue of The Condor free. Notices of over 5 lines will be charged for at the rate of 25 cents per line. For this department, address SIDNEY B. PEYTON, *R. D. No. 2, Box 260, Fillmore, California.*

WANTED—I would like to trade two pairs of 7×50 binoculars for 6×30's light enough for children.—LEONARD WING, *Texas A. & M. College, College Station, Texas.*

FOR SALE—Scientific Library of the late Fred M. Dille, Nogales, Arizona; consists of books on exploration, ornithology, mammalogy, entomology, and other subjects. Write for copy of list now in preparation. Lists of desirata solicited.—MRS. DOROTHY DILLE GRAHAM, *910 St. Charles St., Rapid City, South Dakota.*

FOR SALE—A Natural History of the Ducks by Phillips, 1922, 4 vols. Good condition. Best offer takes.—ROBERT L. RUDD, *314 Alcatraz Ave., Oakland 9, California.*

WANTED—The Auk, vol. 2, nos. 2 and 4, April and Oct., 1885; cash, or can exchange certain other early issues.—ALLAN R. PHILLIPS, *113 Olive Road, Tucson, Arizona.*

FOR SALE

PARTIAL SETS OF THE CONDOR IN GOOD SECOND-HAND CONDITION

We still have a fairly large number of second-hand copies of The Condor from volume 8 to date. Most of these volumes are in perfect second-hand condition and have been donated to the Club by some of our older members.

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COOPER ORNITHOLOGICAL CLUB
Topanga, California

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January 1, 1950

In issuing this new list we have made many changes but have endeavored to price the items as low as is consistent with our limited editions and in accordance with a recent inventory. Many of our publications are now nearly depleted and some entirely sold out. All these publications are sent post paid anywhere in the United States; for sales in California please add 3% sales tax on all items except the Condor magazine.

We are continually buying in old "Club" publications and at times can supply complete files. Send us your want list.

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PACIFIC COAST AVIFAUNA

No. 1, 1900 Birds of the Kotzebue Sound Region, Alaska; 80 pp., 1 map - - - - - - - - - - - - $1.00
By J. GRINNELL

No. 2, 1901 Land Birds of Santa Cruz County, California; 22 pp. - - - - - - - - - - *(Out of print)*
By R. C. McGREGOR

No. 3, 1902 Chest-list of California Birds; 100 pp., 2 maps - - - - - - - - - - - - - *(Out of print)*
By J. GRINNELL

No. 4, 1904 Birds of the Huachuca Mountains, Arizona; 75 pp. - - - - - - - - - - - - *(Out of print)*
By H. S. SWARTH

No. 5, 1909 A Bibliography of California Ornithology; 166 pp. - - - - - - - - - - - - - - - $4.00
By J. GRINNELL

No. 6, 1909 Index to the Bulletin of the Cooper Ornithological Club, vol. I (1899), and its continuation, The Condor, vols. II to X (1900-1908); 48 pp. *(Out of print)*
By HENRY B. KAEDING

No. 7, 1912 Birds of the Pacific Slope of Southern California; 122 pp. - - - - - - - - - - - - - $ .50
By G. WILLETT

No. 8, 1912 A Systematic List of the Birds of California; 23 pp. - - - - - - - - - - - - - - - $ .25
By J. GRINNELL

No. 9, 1913 The Birds of the Fresno District; 114 pp. - - - - - - - - - - - - - - - - - $ .50
By J. G. TYLER

No. 10 1914 Distributional List of the Birds of Arizona; 133 pp., 1 map - - - - - - - - - - - - - $2.00
By H. S. SWARTH
(With all orders for Avifauna 10, we include the supplement.)

Supplement to Pacific Coast Avifauna No. 10. The author, Anders H. Anderson, has brought this state list up to date. Reprint from The Condor, 36, March, 1934, pp. 78-83 - - - - - - - - - - - - - - - $ .50

No. 11, 1915 A Distributional List of the Birds of California; 217 pp., 3 maps - - - - - - - - - $1.00
By J. GRINNELL

No. 12, 1916 Birds of the Southern California Coastal Islands; 127 pp., 1 map - - - - - - - - - - $ .50
By A. B. HOWELL

No. 13, 1919 Second Ten Year Index to The Condor, volumes XI-XX (1909-1918); 92 pp. - - - - $2.00
By J. R. PEMBERTON

No. 14, 1921 The Birds of Montana; 194 pp., 35 illustrations - - - - - - - - - - - - - - - - $3.00
By ARETAS A. SAUNDERS

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